

Miscellaneous Selections :
OR THE
RUDIMENTS of USEFUL KNOWLEDGE,
FROM THE FIRST AUTHORITIES.
DESIGNED FOR
SENIOR SCHOLARS IN SCHOOLS,
AND FOR
Young Persons in General.

CONTAINING
Useful Information on a Variety of Subjects

NOT TO BE FOUND

In any Book, of general Use, in Schools :

AND YET

BY ALL PERSONS,
NECESSARY TO BE KNOWN.

COMPILED BY J. GUY, *K*

Master of the Literary and Commercial Seminary, Bristol :
Author of an English Grammar—Epitome of Geography
and Astronomy—Universal Chart of History, &c.

IN COMPANY, TO DISCOVER CROSS IGNORANCE OF THINGS,
BECOMING ONE'S STATION IN LIFE TO KNOW, IS IN-
SUPPORTABLY MORTIFYING AND DEGRADING.

ANON.

VOL I.

Bristol ;

Printed for the AUTHOR, by R. EDWARDS,
And sold by all the Booksellers in Town and Country.

1796.

Miscellaneous Selections:
 OR THE
 RUDIMENTS OF USEFUL KNOWLEDGE
 FROM THE BEST AUTHORITIES
 SELECTED
 SENIOR SCHOLARS IN SCHOOLS
 AND FOR
 Young Persons in General
 CONTAINING
 Useful Information on a Variety of Subjects



Entered at Stationers' Hall.

Compiled by J. GUY,
 Master of the Library and Comptroller of the British Museum;
 Author of an English Grammar—English Geography
 and Astronomy—Universal History of the World, &c.

IN COMPANY, TO DISCOVER GREAT IMPROVEMENTS OF THE
 BECOMING ONE'S STATION IN LIFE TO KNOW, IS IN
 AUTHORITY MOSTLY NOTING AND READING.

1790

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 And sold by all the Booksellers in Town and Country.

1790

DEDICATION.



TO THE
RISING GENERATION IN GENERAL,
AND
TO THOSE HE HAS INSTRUCTED
IN PARTICULAR,
WHO ARE HIS BEST PATRONS, BECAUSE
HIS TRUEST TESTIMONIES ;
TO WHOM, AS A TUTOR,
HE HAS BEEN ATTACHED BY THE FORCE OF
EARLY HABIT, AND BY THE IRRESISTIBLE IMPULSE
OF A NATURAL INCLINATION ;
FOR WHOM,
AS THE CHIEF BUSINESS OF HIS LIFE,
HE HAS BEEN ACTIVELY AND VARIOUSLY EM-
PLOYED, BY HIS PUBLIC TUITION
AND HIS PRIVATE LABOURS :
AND
AMONG WHOM HE HAS SOUGHT
HIS PLEASURE, HIS INTEREST, AND HIS HONOUR :
THIS LITTLE SELECTION
OF
USEFUL KNOWLEDGE,
ON SUBJECTS OF WHICH NONE SHOULD REMAIN
IGNORANT,
IS DEDICATED,
WITH THE SINCEREST SENTIMENTS OF ESTEEM,
AND BEST WISHES FOR
THEIR TRUEST HAPPINESS,
BY THE
COMPILER.

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DEDICATION

TO THE

RISE OF CONSTITUTIONAL LIBERTY

AND

TO THOSE WHO HAVE RESTORED

THE CONSTITUTION

AND THE BEST NATIONAL INTERESTS

BY

THE

UNITED STATES OF AMERICA

AND

THE

PEOPLE

OF THE

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ADDRESS

YOUNG PERSONS.

YOU boast of having received a liberal Education, and perhaps can tell the *names* of things in Latin, Greek, or French : But you must not stop here. From the knowledge of *names* you must proceed to the knowledge of *things*. A horse (says a lady, who has written excellently for young persons) a horse, without this, will be *but* a horse to you, though you can tell me the appellation in every tongue past or present.

Among all the *manufactories* and *arts*, invented by man for the convenience and benefit of society, what know you of any of them besides their names ?—Of all the *natural objects* that present themselves hourly for your use and inspection, what acquaintance have you, except of their form and common appearance ?—Know you the curious process by which the wool of sheep is wrought up into a firm texture for our cloathing ?—Or how and by what operations, the slender tissue of a worm can be converted into silks, so rich and beautiful ?—How the flax and the cotton, the production of the earth, can receive forms so pliant, and be fabricated into vests so useful and ornamental ?—How, by the loom, materials can be made to assume the resemblance of figures so just, so various, and so beautiful ?

Do you conceive how a concrete of salt and sand, or the black flint stone, can be converted into a beautiful transparent body, such as glass, and be made to minister so excellently to our use and enjoyment ?—Or how the rough iron ore is wrested from the bowels of the earth, and made to flow like a liquid, and again hardened like an adamant ; how, from its high polish it is made to emulate the mirror ; and wrought up into instruments both various and useful ?

Upon what principle, or from whence can a small portion of charcoal, sulphur and salt-petre, derive a power to shake mountains, rend rocks, or dispatch ponderous instruments of instant death to hundreds, or to thousands ?

Know you anything about the parts of your own body, the brain, the heart, or the nerves?—to what wise purposes each is appropriated, and how exactly all perform their functions?—Have you ever observed the nice connection of the human frame, and how fearfully and wonderfully we are made?

Man lives in a state of society, but the very existence of society implies Law, Order, Subordination, Precedence; will you participate the benefits of such society, without a desire to know something of that system, from which you derive domestic, social and relative enjoyment?—From the different quarters of the globe, we are supplied with innumerable productions and fruits?—Can you partake of them without the least curiosity to enquire from whence they came, or how they are produced, prepared and preserved?

Man left to himself, and unassisted by his fellow man, is the most helpless of all animals. A hundred hands have been employed upon the clothes you now wear.—A thousand inventions of your predecessors are administering to your present comforts. If you enquire not into these things, wherein do you excel the lower works of creation—the tree, the shrub, or the stone, which, while arrayed in the varied beauties of nature, remain totally insensible of the sources from which they derive their nourishment.

EVERY OBJECT around you becomes a subject for the exercise of your knowledge. You are prompted to enquiries from motives of real interest, from a natural curiosity, and from the desire which you feel to possess information and accomplishments equal to your rank in life, and that may give you a welcome reception in those circles in which you move. But knowledge is desirable even for its own sake.

By knowledge, man stands pre-eminently distinguished amidst the creation. Knowledge is justly said to be “the solace and delight of the human mind; it is its present dignity, and its expectant consummation.” With *BEASTS* all the beautiful varieties of nature, and all the works and ingenuity of art, are seen without intelligence, or sense of excellence or beauty. Even *MAN*, *rude and uninformed*, gazes on them, ignorant of their natures, while, by a knowledge little more than instinct, he appropriates a few of them to his wants and occasions. But, of the whole creation, *only Man, cultivated and refined*, can view them with the eye of reason, investigate their properties and their uses; and derive from them in a more pure and exalted sense, an intellectual and social enjoyment.

P R E F A C E.

THE utility of SELECTIONS for young Persons, has been abundantly confirmed, by their frequency in almost every language both ancient and modern. To works, in their original form, entrenched with profound Literature, or abstruse terms of Science, the juvenile capacity is seldom found equal. Their formidable appearance alone dismays, and their real difficulties prove so insurmountable that Genius and Emulation, even when united, too often return vanquished from the encounter.

Young Gentlemen and Ladies, after quitting school, and receiving what is termed, a liberal or genteel Education, have been still uniformly found almost totally unacquainted with the nature and quality of the numerous objects with which they were surrounded. Nor could all the school-books together properly supply the information. To remedy this grand defect, many female pens, of the present age have diffused throughout their entertaining publications, with the finest principles of virtue and piety, such a knowledge of the various productions of nature and art, and given such illustrations of particular parts of science, as have well suited the minds of those for whom they were intended,

tended. But such Gems of Knowledge scattered throughout various books, written *only by way of amusement*, cannot be practically applied as school-books, nor studied in the way of the regular school business.

To supply this deficiency and furnish young persons, before they leave school, or on their first appearance in the busy scenes of life, with a regular plan of digested and connected information, is the design of this work. And it may be *particularly noticed*, that this Book treats of no parts of Knowledge *but what are either omitted in other school books, or therein not properly unfolded*, and it includes at the same time *all such particulars as are thus omitted and yet necessary to be known by persons who would boast of having received an education above the vulgar.*

To explain this farther. GRAMMAR and the peculiar construction of LANGUAGE is a necessary part of knowledge for all. ARITHMETIC and BOOK-KEEPING being the handmaids of commerce, are also to many *essential*. GEOGRAPHY and HISTORY are both useful and ornamental. Some clear ideas of ASTRONOMY and the solar system, it would be a shame for a young Gentleman or a Lady to be without. NATURAL HISTORY and EXPERIMENTAL PHILOSOPHY afford sources of exalted pleasure. But these subjects, and others equally beneficial are already drawn up by authors on a scale suited to young scholars, none of these therefore are spoken of at large in the following pages.

A design to supply the deficiency of school books, first induced the compiler to make these Selections, for the use of his own scholars. And the confined application of such when only in manuscript, first dictated the idea of publication.

The original Selections were made from works of the first scientific authority : But since the arrangement of them for the press, many additional articles have been supplied and the whole has undergone some considerable alteration, by consulting Chambers's Cyclopædia and the Encyclopædia Britannica. But from publications of an inferior kind, not a sentence has been selected, for with that view such have never been consulted.

For youth who imbibe so indelibly first impressions; *purity of phrase and expression* in a work of Literature or of Science, is of importance. This consideration has induced the compiler to give his selections as much as possible in the pure language of the original works.

The public taste has left to total neglect, several publications for youth, in which the authors, in order to level their works to the young capacity, have omitted the systematic terms and phrases and substituted words, or rather barbarisms of their own. There are certain technical modes of expression peculiar to every art and science, which should be almost sacredly retained, nor should such subjects be stripped of their characteristic style even for the sake of conveying instruction more easily. The *quantity* should be lessened, rather than have the quality debased.

In

In drawing up this Treatise, the capacities of young persons between the age of twelve and twenty, have been kept in view. A youth of twelve may possibly escape censure if he should be found ignorant herein; but a Gentleman or Lady of one and twenty would be inexcusable without some tolerable acquaintance with these and various other subjects which occur in every conversation, and in every newspaper, and which have some connection with every object that presents itself in Life.—Many intelligent parents, indeed, begin with the very dawn of reason, to inform their children “respecting the objects with which they are surrounded;” teaching them the knowledge of *things* with the first knowledge of *words*. To such, it is hoped this trifle will not be unacceptable. Some there are who suppose the age of maturity, early enough for such a gainless study; and are there not yet others who conceive the whole, at any age, to be altogether useless? And after all the labours of mankind to diffuse knowledge throughout the world, some will still be found, who “with brute unconscious gaze” look on all the objects of creation, on all the labours and ingenuity of Man, on the food that supports them, and on the garments wherewith they are clad. Such ideas indeed should suit only the lowest members of the community, to whom,

“When Ignorance is bliss, ’tis folly to be wise.”
For such, these pages are not intended.

Persons of deep scientific knowledge might perhaps be disappointed in seeking herein for instruction. Let them remember

remember, for *them* it is not designed; but for such, to whom deep researches into abstruse science would be but a confusion of unintelligible words. Nor are the remarks on any of the following subjects sufficient to qualify persons who would study them thoroughly, for to write at large every article would fill a volume. *What is said is barely to inform youth how much they ought to know, even of subjects of which they should know least.*

To the experienced Teacher it may be unnecessary to hint, that the scholar will receive little benefit from a transient reading; and though this is not intended to be learnt by heart, it should be *frequently read over*, till known familiarly.

The SPEAKER, ELOCUTION, ELEGANT EXTRACTS, and OTHER SELECTIONS of the purest compositions, in prose and poetry, have contributed, among youth, to form a correct style, to inculcate the finest sentiments, and to infuse a taste for elegant literature. But let it be remembered, that the *materials* of all compositions, be their nature ever so elevated and sublime, and embellished with whatever rhetorical ornaments, *have their foundation solely in the KNOWLEDGE OF THINGS.* Such a knowledge then it is, that these *RUDIMENTS* pretend to convey. It is presumed on this account, that this work will prove no unacceptable auxiliary to the several purposes of scholastic learning. Let *useful knowledge*, then, accompany, for it will illustrate *polite literature*. It will give intelligence to youth, it will accustom them to habits of reflection and enquiry,

enquiry, and teach them to look on the objects around them with the EYE OF REASON.

Care has been taken to collect the plainest, clearest definitions, to represent a few of the most striking and prominent features, to be neither too tedious in explanations, nor yet so short, as not to leave sufficient traces upon the memory; and, through the whole, parts too complicate and scientific have been omitted. What has been done, little as it is, will, it is hoped, if well improved, serve the young student as a CLUE that may afterwards guide him through all the labyrinths of Art and Science.

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.. Cartilages .. Membrane
.. Flesh .. Brain .. Cere-
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b

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COLOURS and PAINTS.

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PART SECOND.

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ga .. Gum Sandarach ..
Gum Guaiacum .. Gum-
Tragacanth .. Gum-Ara-
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Flounder .. Gudgeon ..

Pearch.. Pike.. Roach..
Eels, &c. &c.

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PART THIRD.

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 Dey .. Bey .. Caliph ..
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 Earl.. Viscount.. Baron..
 Lord.. Baronet.. Seignior
 .. Thane.. Knight.. Esqr.
 .. Gentleman.. Monseigneur---Monsieur---Sire---Sir.

Knights of the Garter..
 Ditto of the Bath.. Of the
 Thistle, &c.

GREAT OFFICES.

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 ... Lord Chancellor ...
 Chancellor of the Exchequer.. Lord high Treasurer .. Lord Privy Seal ..
 Lord President of the Council ... Lord Great Chamberlain .. Speaker of the House of Commons..
 Secretary of State.. Earl Marshall, &c.

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Law .. Acts of Parliament.. Judge.. Serjeant..
 Barrister.. Or Counsellor
 .. Coroner .. Justice..
 Ditto of the Quorum ..
 Inns of Court.. Temple..
 Grand Jury.. Petty Jury
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 Common Law.. Civil Law
 .. Felony.. Perjury.. Larceny .. Treason .. Jurisprudence.. Benefit of Clergy... Habeas Corpus ...
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 .. Defendant.. Mortmain..
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 Lease-hold .. Copy-hold
 .. Subpœna.. Oyes .. Executor.. Assignee.

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 Exports and Imports to foreign Nations.. Funds..
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 .. Bankruptcy.. Coin..
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 --- Speculation--- Officers
 ---Cullom-house--- India-house

house.. Insurance.. Under-writers.. Hans-towns.. Imports and Exports.. Factory.. Sales by Inch of Candle, &c. &c.

HISTORICAL MATTERS.

Æra.. Epoch.. Dynasty.. Cycle.. Julian Year.. Epacts-Gregorian Year.. Secl.. Nones.. Ides.. Calends.. - Olympiad.. Elyfrum.

Scandinavia.. Cimbri.. Huns.. Goths.. Vandals.. Picts.. Lusitani.. Franks.. Gauls.. Amazons.

Heptarchy.. Feudal System.. Vassalage.. Magna-Charta.. Pragmatic Saction.. Ordeal.. Doomsday-book.. Diet.. Shire.. Knights of the Shire.. County.. City--Borough.. Fairs.. Parishes.. Mayor.. Sheriff.. Bailiff.. Sceptre.. Mace.. Wold.. Hythe.. Wick.

MILITARY DEPARTMENTS.

Of the ARMY.

Commander in Chief.. Field Marshall... Field Officer.. Major General.. Lieutenant General..

Bridgadier General.. Generalissimo.. Colonel.. Lieut. Colonel.. Major.. Captain.. Lieutenant.. Ensign.. Adjutant.. Quartermaster.. Subalterns.. Surgeon.. Chaplain.. Serjeant.. Corporal.. Private men... Disabled Soldiers.. Half-pay Officers.. Guards, Horse and Foot.. Dragoons.. Cavalry.. Light Horse.. Light Infantry.. Fusileer Companies.. Grenadiers.. A Troop.. A Company.. A Regiment.. Brigade.. Battalions.. Squadrons.. Janisaries.. Huzzars.. Fortifications.. Siege.. Raising the Siege.. Flag of Truce.. Volunteers.. Militia.. Artillery.. Company, &c. &c.

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SHIPS,

SHIPS, VESSELS, &c.

Ship .. Vessels .. Ships
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.. Frigate .. Sloop .. Fire-
Ships .. Bomb-Vessels ..
Yachts .. Brigantines ..
Sloops .. Store-Ships ..
Hulks .. Hoys .. Smacks ..
Barges .. Privateers .. Gal-
ley .. Convoy .. Squadron
.. Fleet .. Navy.

FIRE ARMS, and Im-
plements of War.

As. Cannon .. Great Guns
.. Ordnance .. Small Guns
.. Mortar Piece .. Bomb ..
Granada .. Musket .. Tar-
get .. Halbert .. Bayonet ..
Poinard .. Pistol .. Cara-
bines .. Bullet .. Shot ..
Chain-Shot ... Gunpow-
der.

PART FIFTH.

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of various

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and Terms.

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cult-Sciences .. Primum
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Physical Causes .. Pneu-
matics .. Mechanics .. Op-
tics .. Phonics .. Hydrosta-
tics .. Ethics .. Physics ..
Metaphysics .. Logics ..

Geometry .. Algebra ..
Fluxions .. Tactics .. Gun-
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Pharmacy .. Chymistry ..
Astronomy .. Astrology ..
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.. Zoology .. Mineralogy
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lours represented by lines
dots, &c. The approp-
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Metals, Precious Stones,
&c. to the subject of He-
raldry.

TERMS in

SCULPTURE.

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Organs .. Harpsichord .. Piano Forte French Horn... Trumpet... Clarion... Drum... Kettle-Drum.

ANCIENT PHILOSOPHERS and PHILOSOPHY.

Philosophy, what it is .. Speculative Philosophy .. Practical.. Corpuscular .. Mechanical, Natural and Moral Philosophy .. Also Pythagorean Philosophy .. Platonic .. Aristotelian .. Peripatetic .. Anacreontic .. Socratic.. Academic .. Cyrenaic .. Epicurean .. Stoics.. Cynics.. Scepticism.. General Observations.

Modern PHILOSOPHY,
Such as Cartesian... Malebranchism .. Newtonian.

RELIGIOUS DISTINCTIONS, &c.

As Druids .. Dervise.. Brachmans .. Pope .. Cardinal ... Arch-Bishop ... Bishop .. Arch-Deacon .. Dean and Chapter Rector.. Vicar .. Curate .. Layman .. Parson ..

Abbot ... Monk.. Friar.. Nun .. Jesuit.

Chapel Church .. Abbey.. Priory .. College .. See .. Synagogue .. Monastery.

University .. Graduate .. Bachelor of Arts Master of Arts.. Bachelor of Divinity .. Doctor of Divinity Bachelor of Laws .. Doctor of Laws, &c.

Sorbonne .. Consistory .. Convocation .. Sanhedrim.. Synod .. Talmud .. Peterpence.. Simony .. Alcoran.

Liturgy.. Rubric.. Dominical Letter... Whit-Sunday ... Pentecost ... Trinity-Sunday ... Ash-Wednesday .. Good-Friday.. Easter .. Christmas .. Twelfth-Day.. Candlemas .. Ember-Weeks ... Palm Sunday ... Vespers Vigils.. Septuagint.

TUTELARY SAINTS

Such as.. St. George.. St. David ... St. Patrick .. St. Dennis. &c.

RELIGIOUS SECTARIES.

As Brachmans... Carthusians.. Jews or Israelites

lites..Pagans..Mahome-
tans..Gnoslics..Heretics
..Huguenots..Noncon-
formists..Atheist..Deist
Theist... Armenians...
Armeneans... Calvinism
.. Lutherism... Arians...
Socinians... Antitrinitari-
ans... Anabaptists... Inde-
pendents... Puritans...
Dissenters... Quakers...
Methodists,

The MONTHS and
DAYS,

As January, February,
&c. Sunday, Monday,
&c. Why so named..
With an explanation of
the Old and New Style.

SUNDRY LITERARY
MATTERS

Explained, as .. Epigram

.. Epitaph.. Emblem..
Acrostic.. Ænigma...
Rebus.. Eclogue.. Epode
.. Ode.. Stanza.. Elegy
.. Prologue.. Epilogue..
Anagram... Epitome...
Madrigal... Pindaric...
Iambic.. Apophthegm..
Epic Poem... Muses...
Belles Lettres.

Definition of TERMS &
PHRASES,

Particularly, of such
Technical and Difficult
Words, as necessarily oc-
cur in this work.

CONCLUSION,
With Notes, References,
and Explanations.

MISCELLANEOUS

Miscellaneous Selections :

OR THE

RUDIMENTS of USEFUL KNOWLEDGE.

IT is an observation, not new, that the first and most important knowledge which should claim the attention of MAN, is the knowledge of himself. Therefore before the young reader is led into an acquaintance with some of the various objects, both of nature and art, which constantly present themselves in an intercourse with the world, it may be proper to open the subject with an inquiry into *his own* nature. The Mind, indeed, before it has attained some degree of maturity, cannot be supposed to enter into a full investigation of *self-knowledge* : but the injunction “*Know thyself*” may, in a sense, be applied even to those for whom these pages are compiled. They may be informed what are the various parts which compose an organized body, animated by a mind which distinguishes him as an animal of a superior nature and entitles him to be considered as “The Lord of the creation.”—We shall therefore first notice a few parts of

THE HUMAN STRUCTURE.

The human Structure is composed of Bones, Muscles, Tendons, Nerves, Arteries, Veins, Cartilages, Membranes.—Also of Chyle, Blood, Milk, &c.

BONE ; a white, hard, brittle, insensible part, and the support of the whole fabric. The *Periosteum* is
A a membrane,

a membrane, tough and sensible, covering the whole surface of the bones. *Marrow* is a soft oleaginous substance in the cavities of the bones. This fine *oil* is exhaled through the pores, supplying the fibres of the bones; and rendering them less apt to break.

MUSCLES are composed of flesh and tendinous fibres, and contain vessels of all kinds. They are the organs or instruments of motion. Muscles which perform voluntary motions receive nerves from the brain, or spinal marrow; those that are involuntary, from the cerebellum, which is the hinder part of the brain. A muscle cannot act when its nerve is cut asunder. *Tendons* are white, firm and tenacious parts contiguous to the muscles, usually forming their extremities.

NERVES are cylindrical whitish parts, like cords, composed of fibres, deriving its origin from the brain, and from the spinal marrow. They are distributed through all parts of the body. They appear to be solid and without cavity; though some suppose there is a cavity and a fluid known by the name of *animal spirits*. Their use therefore seems to be to convey this extremely subtle fluid, secreted in the brain and spinal marrow, for the purposes of sensation and nutrition. Many of our modern physicians, however, deny the existence of this juice.

ARTERIES are hollow canals appointed to receive the blood from the ventricles of the heart, and distribute it to all parts of the body, for the maintenance of heat and life; and for the conveyance of the necessary nutriment. There are *two* principal ones; the *pulmonary* artery arises from the right ventricle of the heart, and is distributed only through the lungs. The *aorta* or *great artery* furnishes all the rest of the body. The *Pulse* denotes the beating or throbbing of the heart and arteries, and it is that reciprocal motion of the heart and arteries whereby the warm blood is thrown out of the left ventricle of the heart, and so impelled into the arteries, as to be, by them, distributed throughout the body.

VEINS

VEINS are a continuation of the extreme capillary arteries, reflected back to the heart: their channels uniting at the approach, till they form three principal veins. In the veins there is no pulse, for the blood is thrown into them with a continual stream, and moves from a narrower channel to a wider.

CARTILAGES are smooth, solid, flexible, elastic parts,—softer than bone, and seem to be of the same nature; some even become bones by time, and some are much softer, and partake of the nature of ligaments. Cartilages have no cavities for marrow, nor any membranes or nerves of sensation.—In the nose, ears and eyelids are cartilages.

MEMBRANE is a thin, white, flexible, expanded skin, formed of several sorts of fibres interwoven together. The use of membranes is to cover and wrap up the parts of the body; strengthen them, and save them from external injuries, &c.

FLESH; a fibrous part of an animal body, soft and bloody, being that whereof most of the other parts are composed, and whereby they are connected together. The ancients made five different kinds of flesh, the first *muscular*, as the heart and muscles, the second *parenchymous*, as that of the lungs, liver, spleen; the third *viscerous*, as the flesh of the stomach and intestines; the fourth *glandulous*, as that of the breast, &c. and the fifth *spurious*, as the gums, lips, &c. The moderns, however, admit only of one kind, viz. the muscular, consisting of little tubes or vessels with blood therein, so that fleshy and muscular parts of the body are with them the same. In the flesh the blood vessels are so small as only to retain blood enough to preserve their colour red.

The **BRAIN** is a soft, whitish mass, inclosed in the cranium or skull; wherein all the organs of sense terminate, and the soul is supposed principally to reside. The brain is encompassed with two membranes called *dura* and *pia mater*. Its figure is roundish, oblong,

and flat on the sides : it is divided into three principal parts, viz. the *cerebrum* or brain strictly so called, the *cerebellum*, and the *medulla oblonga*.

The **CEREBRUM** consists of *two* kinds of substance : The exterior one, called the *cortex* is ash coloured, soft and moist ; the other, or inner part, is white, more solid and more dry ; this is called the *marrow* or *medullary* and sometimes the *fibrous* part, in contradistinction to the other which is also called the *glandulous* part. Most authors suppose the exterior part to consist of *innumerable minute glands*, destined for the secretion of animal spirits from the blood ; and that the inner or medullary part is composed of *innumerable fine fibres* which communicate with the nerves. By turning up the brain the origins of the nerves proceeding from it are distinctly seen. These are in number ten pair, among which are the *olfactory* nerves, *optic*, movers of the eyes, auditory nerves, and the *pathetic*.

CEREBELLUM ; the hind part of the brain—it is esteemed a kind of *little brain* by itself. Its colour is yellowish, and its figure somewhat resembles a flat bowl, longer than broad. Its substance is harder and more solid than that of the brain, but of the same nature.

MEDULLA OBLONGA is the medullary part and the *cerebellum* joined in one. The *medulla spinalis*, or *spinal marrow* is also but a continuation of the *medulla oblonga* : and as the *spine* is an assemblage or series of bones of the back which support the rest of the body, so the *spinal marrow* is the origin of most of the nerves of the trunk of the body.

HEART ; part of the animal body, wherein all the veins terminate ; and from which all the arteries arise. It is the chief instrument of the circulation of the blood. The heart is of a fleshy or musculous substance. The figure of a heart is a cone, or pyramid reversed. Its size is various, ordinarily in length about six inches, its breadth at the basis four or five. It is immediately connected with the great blood vessels. Some consider

the

the heart as a double muscle or as two muscles tied together by numerous fibres. The heart has an alternate motion of *contraction* and *dilation* for the purpose of circulating the blood throughout the whole body. Some say there have been two hearts found in one man. Divers insects have naturally several hearts : and silk worms have a chain of hearts running the whole length of their bodies.

LUNGS.—The lungs are only an assemblage of membranous vesicles or cells inflated with air. They are connected above to the fauces and below to the thorax. The whole substance of the lungs is covered with a common membrane, the outer part of which is thin, smooth and nervous ; the inner part somewhat rougher, consisting mostly of the extremities of vessels and vesicles, through the impression of which it is pitted, and resembles a honeycomb. The *vessels* of the lungs are the *bronchia*, the pulmonary and bronchial arteries and veins, nerves and lymphatics. Of these vessels some are *proper* and others *common* in respect to the service they are of to the rest of the body. By blowing into any of the tubes or branches of the bronchia, those cells or vesicles of the lungs are inflated or blown up. *Diemerbroeck* observes, that the vesicles admit not only of air, but also of other gross matters ; and he instances two asthmatic persons which he opened ; the one a stone-cutter, the visculæ of whose lungs were so stuffed with dust, that, in cutting, his knife went as through a heap of sand ; and the other a feather-driver, in whom the vesicles were full of the fine dust or down of feathers.

LIVER.—The liver is a collection of glands wherein the bile is separated ; or, it is a large glandulous viscus, of a red sanguine colour. It stretches itself over the right side of the stomach. Its figure is somewhat approaching to round. The liver has a motion which depends on the diaphragm, to which being very firmly connected, it must needs obey, and in expiration be drawn up, and in inspiration be let down again. The liver serves to purify the mass of blood, by making a secretion of the billious humour it contains. The blood

conveyed into the liver by the porta, after the manner of the arteries, is received again, after having been purged of its *bile* in the glands of the liver, into innumerable veins, which empty themselves into the *cava*, which is the common channel by which the blood returns to the heart. The liver also delivers part of its bile unto the gall bladder, by a duct, called the *cyst hepatic duct*, first discovered by Dr. *Glisson*. Besides these gall-vessels which are peculiar to the liver, it abounds with blood vessels, especially veins. The French call the liver *foye* from *foyer*, *focus*, or fire-place, agreeable to the doctrine of the ancients, who believed the blood to be boiled and prepared in it.

SPLEEN.—The spleen is a spungy viscus, of a darkish red, or rather livid colour, somewhat resembling the figure of a tongue, though sometimes triangular, and at other times approaching to round. It is usually single, though sometimes there are two; and even three have been found. It is situate between the spurious ribs and the stomach. Its ordinary length is six inches; breadth three, and one thick. It is connected by the blood vessels to the stomach and left kidney. It is covered with two tunics, the inner one consists of fibres very curiously interwoven. From this probably, are derived those innumerable cells or little bladders which make up the main bulk of the spleen, though *Malpighi* thinks otherwise. The *use* of the spleen has been disputed in all ages, both, as no immediate use appears from dissection, and as we find that animals from whom it has been cut, live very well without it. But Mr. *Cowper* takes it to be a subordinate organ, ministering to the circulation. According to Dr. *Boerhaave*, the spleen receives the fresh arterial blood, prepares it in its glands, and pours it into its cells; mixes the humour thus prepared with the nervous juice, and more intimately unites them together.

The **KIDNEYS** are a mass of glands, for separating the urine. They have arteries, veins, and nerves.

The

The GLANDS were thought by the ancients to be nothing more than a kind of pillows for the neighbouring parts to rest on. Some afterwards fancied them sponges, to receive and imbibe the superfluous moisture of the other parts. Later physicians assigned them more important uses. They considered them as cisterns which contained proper ferments, whereby the blood was put into fermentation, in the progress whereof it worked and threw off certain of its parts, and sent them away by excretory ducts. The moderns considered them as a kind of filters, for separating the vital fluids for the use of the body : and the latest authors consider the glands as sieves whose perforations being of different sizes, though of the same figure, only separate such particles whose diameters are less than their own. The Glands are a soft spongy lax kind of body. They appear to the eye whitish, membranous masses. A gland is a composition of divers kinds of vessels, viz. an artery and a vein, a nerve and a membrane.

CHYLE is a whitish juice into which the food is immediately converted by digestion. It is a mixture of the oily and aqueous parts of the food incorporated with the saline ones. Some take chyle to be the immediate matter of nutrition, others, the blood.

BLOOD ; a warm red liquor or humour, circulating by means of arteries and veins through every part of the body. The blood when let out of the body spontaneously, separates into two parts, the one red which coheres into a mass, and is called *crassum* ; the other thin and transparent, which retains its fluidity, and is called the *serum*. The origin of the blood is in the *chyle*, which passing the lacteals, and mixing with the blood, they proceed together to the right ventricle of the heart, and there being yet more intimately connected they circulate together through the whole body. As to the *heat* of the blood, authors are exceedingly divided ; some have recourse to the chymical principles of alkali and acid, others to the mutual action of the component parts of the blood. Dr. Drake attributes it to the spring of the air inclosed within it, which agitates and produces

ces heat, fluidity, &c. The *redness* of the blood is also matter of conjecture. The chymists account for it from the exaltation of its sulphur: some from the mixture of saline and subacid juices, with sulphurous ones; and others from the colour of the heart. Some again from the impregnation of the air in the lungs. *Red* is however a colour not absolutely necessary and essential, there being animals whose blood is white and limpid.

Dr. *Lowther* computes the quantity of blood in a human body to be about 20lb.—others think variously.

MILK is thicker, whiter and sweeter than the chyle itself from which it is derived, and that probably without much more alteration than the leaving behind some of its aqueous parts. Milk is a composition of three different kinds of parts, butyrous, caseous, and ferous.

Of the SOUL and its FACULTIES.

SOUL is defined a spirit proper to inform and animate an organized body; and by its union constitute a reasonable animal. Philosophers are not agreed as to the manner wherein the soul resides in the body. Some hold it equally diffused through every part. Others say it influences every part of the body, though it has its principal residence in some particular part. *Des Cartes* maintains its residence is in the pineal gland of the brain, where all the nerves terminate.

MIND denotes a thinking or understanding being. Philosophers allow of three kinds of mind, God, angel, and the human soul. The human mind is properly defined a thinking rational substance. By thinking it is distinguished from body, and by reasoning from God and Angels, who are supposed to see and know things intuitively, without the help of deduction and discourse.

UNDERSTANDING is defined to be a faculty expressive of things, which strike on the external senses

ses either by their images or effects, and so enter the mind. The understanding has two offices, viz. *perception* and *judgment*.

PERCEPTION; the act of *perceiving*, or apprehending; or that simple idea which we have of a thing, without making any affirmation or negation.—Thus, when we hear the word *ship*, the idea we then form in the mind is called *imagination*; but when we hear of a thing, whereof no image can be framed, the idea we then have is a mere *perception*. The power of perception constitutes what we call the *understanding*. The ideas we receive by *perception* are often altered by the *judgment*. The faculty of perception seems to be that which puts the distinction between the animate and inanimate part of creation. It is a metaphysical principle, and found in some degree in all animals, and in them alone. Perception is of three sorts, the perception of *ideas* in our minds; the perception of the signification of signs; and the perception of the agreement and disagreement of distinct ideas.

JUDGMENT is a faculty, or rather an *act* of the human soul, whereby it compares its ideas, and perceives their agreement or disagreement. Thus the understanding compares the two ideas of the sun and the moon, and finding the idea of the sun greater than that of the moon, the *judgment* decides, and the will acquiesces in that decision.

The difference between *perception*, *judgment* and *reasoning*, so far as the understanding is concerned in them is this; that it perceives a thing simply, without any relation to any other thing, in a simple *perception*; that it perceives the relations between two or more things in *judgment*; and lastly that it receives the relations that are between the relations of things in *reasoning*.

WILL.—Some take will to be the mind itself, considered as embracing or refusing, adding that as the understanding is nothing else but the soul, considered as perceiving; so the will is the soul considered as *will-*

ing. But Mr. Locke, more intelligibly defines the *will* a faculty which the soul has of beginning, forbearing, continuing, or ending various actions of the mind, and motions of the body, barely by a thought or preference of the mind. Father Malebranche lays it down that the will is that to the soul which motion is to the body.

IDEA; an image or resemblance of any thing, which though not seen is conceived by the mind. Ideas are said to be *true* or *false*, *adequate* or *inadequate*, *real* or *fantastical*. Adequate ideas are those which perfectly represent those archetypes which the mind supposes them taken from. Inadequate ideas are such as do but partially or incompletely represent those archetypes to which they are referred. Thus, a person who has not seen St. Peters at Rome, forms, from description, an idea of that building, and such an idea may be called *inadequate*. Ideas are either *simple* or *complex*. Simple ideas include all those which come into the mind by sensation. The ideas of colour are acquired by the eye; sounds by the ear; heat by the touch. Some simple ideas are formed by sensation and reflection conjointly, as those of pleasure, power, existence. Complex ideas are infinite—some are not supposed to exist by themselves, but are considered as dependencies on or affections of substantives, such are *triangle*, *gratitude*, *murder*, &c.—Combinations of simple ideas are such as a dozen, a score, beauty, theft, &c.

KNOWLEDGE, according to Mr. Locke, consists in the perception of the agreement or disagreement of our ideas. A man may be said to *know* all those truths which are lodged in his memory, by a foregoing clear and full perception. In *intuitive knowledge* the mind perceives the truth as the eye does light; thus the mind perceives that white is not black, that three are more than two; this part of knowledge is irresistible, and on this intuition depends all the certainty of our other knowledge. But when the mind is obliged to discover the agreement or disagreement, by the intervention of other ideas, that becomes what we call *reasoning*. We can have no knowledge farther than we have ideas.

MEMORY ;

MEMORY ; a faculty of the mind, whereby it retains the ideas it has once received. Or it may be called the storehouse of our ideas. The mind has a power to revive perceptions which it once had, with this additional one, that it has had them before. Of all the faculties there is none harder to account for, or that has perplexed philosophers more than the memory. *Dr. Hook* makes it consist in a stock of ideas or images, formed occasionally by the mind, out of the fine parts of the brain, and disposed or laid up in order. *Des Cartes* maintained that the animal spirits exciting a motion in the most delicate fibres of the brain, leave a kind of traces or footsteps, which occasion our remembrance. *Father Malebranche* expresses his notion of memory thus : As all our perceptions are owing to changes happening in the fibres of the brain, the nature of the memory is obvious : for, as the leaves of a tree that have been folded for some time, preserve a facility to be folded again ; so the fibres of the brain, having once received impressions by the course of the animal spirits, and by the action of objects, preserve a facility to receive the same disposition ; and it is in this facility that memory consists. But there is still a difficulty to conceive how such an infinite number of things as the head is stored with, should be ranged with so much order in the memory, as that the one should not efface the other ; and how, in such a prodigious assemblage of traces impressed upon the brain, the animal spirits should awake to precisely those which the mind has occasion for.

Seneca says he was able, by the mere effort of his natural memory, to repeat two thousand words upon once hearing them, each in its order, though they had no dependence or connection on each other. He afterwards mentions a friend of his, *Portius Latro*, who retained in his memory all the declamations he had ever spoke ; and never had his memory fail him in a single word. *Cyneas*, ambassador to the Romans, for king *Pyrrhus*, had in one day so well learnt the names of his spectators, that the next he saluted the whole senate, and all the populace assembled, each by his name. *Pliny* says *Cyrus* knew every soldier in his army by name, and *L.*

Scipio

Scipio all the people of Rome. *Carneades* would repeat any volume found in the libraries as readily as if he were reading. Many more instances of the prodigious powers of memory might be adduced, if they were not somewhat foreign to the present plan.

FANCY is the same with Imagination.

IMAGINATION; a power or faculty of the mind, whereby it conceives and forms ideas of things, or images of objects communicated by the outward organs of sense, and making impressions on the fibres of the brain. The species of objects, once received by the common senses, are by imagination retained, recalled, examined, compounded, or divided. Thus by the fancy or imagination, the ideas of absent things are formed and presented to the mind as if they were present. In men the imagination is supposed to be subject to reason; but in brutes it has no superior, this being the *ratio brutorum*, or what we call, reason in brutes. In Poets and Painters this passion should be the predominant one, to enable them to feign, pursue and execute their fictions or fables with more strength, consistency, &c.

To explain this faculty yet farther, and shew wherein and how it differs from sensation, it must be observed, that the organs of our senses are composed of fibrillæ or little fibres, which at one end terminate in the outward parts of the body, and at the other in the middle of the brain. These fibres may be moved two ways, either beginning at the end which terminates in the brain, or that which terminates without. Now, whenever these fibres are any way moved or agitated, the mind or soul is affected. If then the fibres on the outward parts of the body be moved, it is called *sensation*; if the inward fibres in the brain be moved, it is termed *imagination*. When the body is in action, the nerves or fibres have a certain degree of tension, as in the case of an extended cord fastened by its ends; one part of which can never be stirred without communicating a like motion to every part. In *sleep*, when the nerves are in a state of relaxation, the soul does not easily receive new sensations.

According

According to the doctrine of *Malebranche*,—as often as there happens any alteration in the nerves or fibres in the brain, by the course of the animal spirits, or by any other manner, there happens a new perception in the soul, or a new imagination.

SENSATION, from what has been observed, may be defined the act of perceiving external objects by any of the organs of sense.—SENSE is distinguished into external and internal. The five *external senses* are hearing, seeing, tasting, smelling and feeling. The *internal* ones are imagination, memory, attention, to which some add hunger and thirst.

In quitting these faculties of the mind, it may be noticed, that when the mind turns itself inwards upon itself, thinking is the first idea that occurs; wherein it observes a great variety of modifications, and from whence it frames to itself distinct ideas. Thus the perception annexed to any impression on the body, by an external object, is called *sensation*. When an idea occurs without the presence of the object, it is called *remembrance*; when sought for by the mind and brought again into view, it is *recollection*; when the ideas are as it were registered in the memory, it is *attention*; and when the mind fixes its views on any one idea, and considers it on all sides, it is called *study*.

THE PASSIONS.

PASSION is ascribed to the different motions and agitations of the soul. Philosophers are not agreed about the number and division of the passions. Some attribute eleven kinds of passions to the soul. The common distribution of them is into the passions of the *concupiscible appetite*, such as pleasure, pain, desire, aversion, love and hatred, and those of the *irascible appetite*, which are anger, courage, fear, hope and despair. Some again observe that the most natural division of the passions is into the *pleasurable* and *painful*. In

this sense all the passions may be reduced to *love* and *hatred*—but perhaps to one, *love*; and even that may be all resolved into *self-love*. This is considered a principle of self-preservation, or a necessary and invincible desire of pleasure and happiness. The rest are only rivulets from this source, or special applications of this principle to particular occasions. Thus the desire of any thing under the appearance of its goodness, suitability, or necessity to our happiness, constitutes the passion of *love*; the desire of eschewing any thing hurtful or destructive, constitutes *hatred* or aversion; the desire of a good which appears probable and in our power constitutes *hope*; but if the good appear improbable or impossible, it constitutes *fear*, or *despair*. The unexpected gratification of desire, is *joy*; the desire of happiness to another under pain or suffering, is *compassion*, and the desire of another's punishment, *revenge*, or *malice*.

The *single desire of happiness*, then, is the spring or motive of all our passions. Some wise and reasonable motive, or end of action, says Dr. *Morgan*, is certainly necessary to all wise and reasonable action. To act without a motive would be the same as not to act at all; that is, such an action would answer no farther or better end than not acting: But whatever wise ends are intended by them, if they are not kept under due regulation and restraint, they soon become the sources of all our misery. The natural and occasional cause of all our passions, *Malebranche* makes to be the motion of the animal spirits, which are diffused through the body to produce and preserve a disposition suitable to the object received. He ascribes the origin of concupiscence to those impressions made on the brain of our first parents at their fall, which are still transmitted and continued on those of their children: and the dominion or prevalence of concupiscence, according to him, is what we call original sin.

MINERALS.

METALS, SULPHURS, SEMI-METALS, &c.
are MINERALS.

METAL; a simple, ponderous, shining, fixt, fossil body, that fuses and becomes fluid by fire, coagulates and hardens by cold. There are but *six metals* in all nature, viz. *gold, lead, silver, copper, iron, and tin*, to these a seventh is usually added, viz. *mercury*, but it has not all the characters of a metal, but is rather the mother or basis of all metals. The common radical character of *metals* is, that of all known bodies they are the heaviest. As to the origin and formation of metals, it is conjectured, that they are generated of *mercury, sulphur* and *salt*:—their matter and weight being taken from the mercury, and their tincture and form from sulphur.

GOLD; the heaviest, purest, most ductile and shining, and on these accounts the most valuable of metals. All the known parts of the earth afford this metal, though not with equal purity or abundance. Europe furnishes but *little*. That from Asia is esteemed the *finest*, particularly in the East-Indies. America furnishes the *most*, particularly the mines of Peru and Chili. The gold of Axima on the coast of Africa is found from 22 to 23 carats fine. Though gold be chiefly found in mines, some is found also in the sand and mud of rivers and torrents. The manner of refining and purifying gold will be noticed under the head of manufactories.

SILVER; a white, rich metal, being the finest purest, most ductile and most precious of all metals except gold. There are *silver mines* in all the four quarters of the world.—Europe has its share—our own island is not quite destitute thereof, though they are of little value. The mines of Peru and other parts of America are by far the richest—they appear almost in exhaustible, particularly those of Potosi. Many millions of Indians have perished in them, and prodigious

numbers continue to be destroyed yearly ; for the exhalations arising from them are of a very poisonous quality. The method of separating silver from the ore, is with quicksilver, the same as that of gold.

LEAD ; a coarse, heavy, impure metal, and of all others the softest and most fusible when purified. Lead is found in various countries, but abounds particularly in England. It is found, too, in several kinds of soils and stones, some whereof, besides, contain gold, some silver, others tin. Some observe that lead increases in weight, either in the open air or on the ground. Mr. Boyle observes that the lead of churches frequently grows both in bulk and weight so as to become too ponderous for the timber that before sustained it ; others, however, absolutely deny this to be the case.

COPPER ; a hard, dry, heavy, ductile metal ; found in mines in several parts of Europe, but mostly in Sweden. Copper is found both in dust and in stones, each of which are first well washed to separate them from the earth.—**BRASS** is formed of a mixture of copper and lapis calaminaris. Copper melted with fine tin makes *bell-metal* an equal quantity of Brass and Copper melted makes what is called Bronze, for statues, &c.

IRON is a hard, fusible, and malleable metal. It is the hardest, driest, and most difficult to melt of all metals ; it may be softened by heating it often in the fire, and it is hardened by extinguishing it in water ; Iron has a great conformity with Copper ; and the two are not easily separated when soldered together. It has a great conformity, too, with the loadstone. *Rohault* says it is itself an imperfect loadstone. There are several kinds of Iron. *English Iron* fittest for fire-bars and such uses. *Swedish Iron* is a fine sort, and best to work upon. *Spanish Iron* would be equal to the Swedish were it not subject to crack when between hot and cold. The *German Iron*, called *Dortsquare*, is a coarse Iron fit only for ordinary uses. The Iron of which *wire* is made is the first that runs from the mine-

mine-stone when it is melting, as it is the softest and toughest.

We have a great number of Iron-works in most parts of England; those in the Forest of Dean, in Gloucestershire, are in great repute.

STEEL; a kind of iron refined and purified by fire with other ingredients, which render it whiter, and its grain closer and finer than common iron.

TIN; a whitish metal, softer than silver, yet much harder than lead. It is found in both lead and silver mines, and it is supposed to be a compound of both.—The greatest part of the tin consumed in Europe, is procured from the mines of Cornwall and Devonshire. *Camden* supposes the abundance of tin in these two provinces to have given the name Britain, to the whole country.—In the Syriac language, *varatanac* signifies *land of tin*, from which *Bochart* derives the name *Britain*.—The principal properties of Tin are, that it is the lightest, the most fusible and the most volatile of all metals. *Pewter* is a factitious metal; its basis is tin, with a mixture of brass and lead.

MERCURY; a fluid, mineral matter, resembling silver in fusion. It is known under a great many denominations. Among the ancients it was *Hydrargyrum*, *q. d. water of silver*. The moderns call it Mercury, from some supposed resemblance it has to the planet of that name. In English it is popularly called *Quick-silver*. Many of the Chymists call it *Proteus*, from the variety of forms, colours, &c. it passes through in their examinations.—Of all bodies, it is the heaviest after gold, and still the purer it is, the heavier.—It is likewise of all bodies the most fluid: there is scarcely any cohesion at all in the parts of Mercury. *Boerhave* observes that it is very improperly called a metal, as it has not all the characters of such a body, nor scarcely any thing in common with the other metals, except weight and similarity of parts, thus, for example, it is neither dissolvable by fire, malleable, nor fixed.

Of all bodies Mercury is divisible into the minutest parts. Thus being exposed to the fire, it resolves into a fume scarcely perceivable to the eye; but in whatever manner it be divided it still retains its nature, and is the same specific fluid. With whatever bodies Mercury be mixed, in order to fix it, it is easily separated again by fire, and reducible into pure *Mercury* as before.

The chief *mines of Mercury* are those of Hungary, Spain, Friuli and Peru.—The greatest part of our Quicksilver is brought from Friuli. It is found under three several forms:—In ruddy glebes, called *cinnabar*; in hard, stony glebes of a saffron colour. It is also found pure, for upon opening holes in the beds of stones, there sometimes gushes a vein or stream of *pure Mercury*, called *virgin Mercury*.

SULPHUR; a fat, unctuous, mineral substance, fusible and inflammable by fire, and not dissoluble or miscible with water.—Sulphurs are divided into *solid* and *fluid*. The solid are Arsenic and Amber. The liquid are Bitumen, Petroleum, Oleum terræ, &c. *Sulphur, properly so called*, or Brimstone, is of two kinds, *vivum* and *common Sulphur*.

Sulphur vivum, is dug in this form out of the earth. It is opaque, of a yellow or ash colour; it easily takes fire, and in burning casts a strong sulphureous smell; comes from *Ætna*, *Vesuvius*, and several parts of Italy and Switzerland; but the best is that of *Quitto* and *Nicaragua* in America.

The *common Sulphur* is that used in gunpowder, and divers other occasions. It is said to be the native sulphur with *rosin* rolled up into cylindrical pieces. Holland, Venice and Marseilles are the chief places from which it comes. This kind is used in whitening silken, woollen and cotton stuffs.

Flower of Sulphur is the purest part of common Sulphur, gained by evaporation, by sublimation or burning it in pots for that purpose, and gathered in the capital of the cucurbit, where the vapour sticks. This preparation is excellent for the *lungs*.

ARSENIC is ranked in the class of sulphurs. It is a ponderous mineral substance, volatile and unflammable: it proves extremely corrosive to animals, so as to become a violent poison.—There are divers kinds, as the *yellow* or *native*, *red*, and *crystalline*, or *white*. The *native* or *yellow*, is from its colour called *auripigmentum*, or *orpiment*. It is found in copper mines, in a sort of glebes or stones of different figures and sizes. Its colour admits of various shades and mixtures. It is found to contain a small portion of gold, but so little as not to be worth separating. *White* or *crystalline arsenic* is drawn from the native yellow, by subliming it with a portion of sea-salt. It is this species chiefly in use among us for real *arsenic*. *Red arsenic* is a preparation of the white, by adding to it a mineral sulphur. Butter and cow's milk taken in large quantities, prove good antidotes against arsenic.

ORPIMENT is a species of arsenic. That which is usually called *red orpiment* or *red arsenic* is only the yellow arsenic heated to a great degree, and put into a crucible with oil of hemp-seed, olives, or nuts.

Painters, Farriers, &c. make a great consumption of this mineral; but as it is found a violent corrosive and reputed a poison, it must be used with great precaution. The Indians use orpiment, corrected with juice of lemons, with good success against fevers.

BITUMEN; a fat, tenacious, mineral juice, very inflammable; or a fossil body which readily takes fire, yields an oil, and is soluble in water. Bitumens are either *hard*, *soft* and *liquid*, or *oily*.—Some again are fossil—others are found floating on the surface of certain lakes—others spring from the earth like fountains, as at Pitchford, in Shropshire—some are so glutinous that they serve instead of cement or mortar in buildings, of which kind it was that the famous walls of Babylon were built: and others so liquid that they are burnt in lamps instead of oil. The bitumen in most esteem is that of Judea. Among the hard bitumens may be reckoned Pit-coal.

PIT-

PIT-COAL; a black, sulphurous, inflammable matter, dug out of the earth, serving in many countries as the common fuel. Pit-coal is also called *fossil-coal*, *earth-coal* and *natural coal*. It is common in most countries of Europe, though the *English coal* is in most repute, even in foreign countries. The commerce of coal is very considerable in England; great quantities are exported to France, &c. by way of Rouen. The goodness of coal consists in its being as free as possible from sulphur, in its heating iron well, and in its burning a long time in the smith's forge. The English coal has this peculiar to it, that it never lights so perfectly as when water is thrown on it.

SEMI-METALS, EARTHS, &c.

ZINK; a kind of metalline substance, hard, white and brilliant. It is not sufficiently ductile to be denominated a metal, yet stretches a little under the hammer. It is used to purge and purify tin. Founders, toymen, &c. use it with turmeric to tinge copper, &c. It gives a fine gold colour, though not a very lasting one. Zink is the same with what is otherwise called **SPELTER**. It is found in the greatest quantity in the mines of Gosselaar in Saxony: it is commonly sold in large, square, thick cakes, whence one would judge it to have been melted as it came out of the mines, and cast in that figure. Some mistakenly confound it with *female antimony*, others with spaa and bismuth.

BISMUTH is a mineral body, half metallic: it is found usually in silver and tin mines, and is composed of the first matter of tin while yet imperfect. It is also called *tin glass*, because when broke it shews a vast number of little polished laminæ like glass. Bismuth contains an arsenical salt, very dangerous to take inwardly. There is also an artificial Bismuth which is that ordinarily found in shops, made by reducing tin into thin laminæ, or plates, and cementing them by a mixture

mixture of white tartar, salt-petre, and arsenic. The same is made with zink, using lead instead of tin, and a little calamine. Bismuth is also called *marcasite*.

MARCASITE contains the seed or first matter of metals; the name is applied to every mineral body that has metallic particles in its composition, though not enough to make it worth working: in which case it would be called *Ore*. There are three kinds in the shops, *Marcasite* of gold, of silver, and of copper: Though some repute the loadstone *Marcasite* of Iron. *Marcasite* are found in mines of metals.

MAGNET, or LOADSTONE; a sort of ferruginous stone, in weight and colour resembling iron ore, though somewhat harder and more heavy, endued with divers extraordinary properties.

The most distinguished properties of the Magnet, are, that it points to the poles of the world, and that it attracts iron, and it also communicates these properties by touch to iron; on which foundation are built the mariner's needles.

The attractive power of the magnet was known to the ancients, and is mentioned by *Plato* and *Euripides*, who call it the *herculean stone*, because it commands iron, which subdues every thing else. But the knowledge of its directive power, disposing needles and pieces of iron to point along the meridian of every place nearly to the north, is of later date; though the exact time is still unknown. In 1260, *Marco Polo* the Venetian, is said by some to have introduced the Mariner's compass, not as an invention of his own, but as derived from the Chinese. Some imagine that the Chinese borrowed it from the Europeans.

The Magnet is usually found in iron mines, and sometimes in very large pieces, half magnet, half iron. Its colour is different according to the different countries it is brought from. *Norman* observes that the best are brought from China and Bengal, which are irony or of a sanguine colour; those of Arabia are reddish, those of Macedonia blackish; and those of Hungary, Germany, England, &c. the colour of unwrought iron. Neither

ther its figure nor bulk are determined, it is found of all forms and sizes. The ancients reckoned five kinds of Magnets, different in colour and virtue: the Ethiopic, Magnesian, Bæotic, Alexandrian, and Natolian; the chief use they made of it was in medicine, for the cure of burns and defluxions on the Eyes. The moderns are more happy, in taking it to conduct them in their voyages.

Dipping-needles, instead of playing horizontally and pointing out North and South, dip or incline downwards to the horizon. The inventor of the dipping-needle, was without all question, an Englishman, *Robert Norman* by name, and a compass maker at Wapping, about the year 1576. The occasion of the discovery he himself relates; that it being his custom to finish and hang the needles of his compasses, before he touched them, he always found that immediately after the touch, the North point would bend or decline downwards. The constancy of this effect, led him at length to observe the precise quantity of the *dip*, or to measure the greatest angle which the needle would make with the horizon. *Burrows, Gilbert, Ridley, Bond, &c.* endeavoured to apply this discovery to the finding the latitude, and *Mr. Whiston*, to the finding the longitude thereby, which is now performed with considerable exactness.

TAMBAC, or TAMBAQUE; a mixture of gold and copper, which the people of Siam hold more beautiful, and set a greater value on than gold itself. Some travellers speak of it as a metal found in its peculiar mines. The *Abbe de Choisy*, doubts whether it may not be the *electrum*, amber, of *Solomon*. The Ambassadors of Siam, brought several works in Tambac to Paris, in the reign of Louis XIV. which were not found so beautiful as was expected.

BLACKLEAD; a kind of mineral stone of a black colour, but silvered and shining; found chiefly in lead mines. It appears to be nothing else, but lead, not yet arrived at maturity; and is much used for Pencils, or crayons for designing. It is melted like the common lead.

OKER,

OKER, or **OCHER**; a yellow, dry, fossil earth; harsh to the touch, found in copper and lead mines, sometimes in those of silver, and sometimes in mines of its own. Though Oker be called an earth, yet it seems more rightly to refer to the class of *semi-metals*. It consists of earth and a metal, particularly iron combined. Mr. Boyle says he has seen a piece of oker richer in metal than most iron ores; and which was even rendered magnetical by heating and then cooling it in a perpendicular position. Some Authors esteem oker proper to promote the melting of metals, when they are too harsh and brittle; but its chief use is in *painting*.

The *yellow* oker is the natural, the *red* is prepared from the yellow by calcining it in the fire till it have acquired its redness.

The beds are usually from one hundred and fifty to two hundred feet deep; their thickness from four to eight inches. The best oker is that of Berry, in France. There are several kinds dug in England, all bordering on the red, some of them used in polishing looking-glasses.

BOLE or *Bole Armeniac*, or the *Armenian Bole*, is a soft, friable, fat earth of a pale red colour, easily pulverized, and which adheres to the tongue; esteemed a good drier, and used in divers diseases externally and internally.

Bole of the Levant, is an earth, nearly of the same nature, Pomet says that all boles now in use come not from the Levant, &c. but from France or the neighbouring countries. Some with more probability, think that it is the Levant bole which passes among us for the armoniac.—There is also a medicinal substance, called *Japan Earth*, very austere upon the palate, seeming to melt, like bole in the mouth and leaving somewhat of a sweetish taste behind it: but to what genus or kingdom it belongs is not well agreed on.

CHALK; a white fossil substance, usually reckoned as a stone, but Dr. Stare says without reason: Since, when examined by the hydrostatical balance, it is found to want much of the weight and consistence of a real stone.

stone. He thinks it more justly ranked among the *boles*. This he observes to be the case not only in chalk, but various other bodies taken to be stones, which are nearer to earth, sulphur, metal, &c. than stone. There are two kinds of chalk. A hard, dry, strong chalk is used for making of lime; and a soft unctuous chalk used to manure lands; as easily dissolving with rain, and frost. It is for cold, sour ground, and promotes the yielding of corn; it sweetens grass so as to cause cattle to fatten speedily, and cows to give thick milk.

Chalk is also used in medicines, as an astringent, an absorbent and a sweetner; and it is celebrated for curing the heart-burn almost beyond any thing whatsoever.

FULLERS' EARTH; a fatty, fossil earth, abounding with nitre, and of great use in the woollen manufacture. It serves to scour cloths, stuffs, &c. It imbibes all the grease and oil necessarily used in the preparing and dressing of the wool. Fullers' earth is dug in great plenty out of certain pits near Brick-Hill in Staffordshire. As it is absolutely necessary to the well dressing of cloth, foreigners, without obtaining this article can never reach to the perfection of the English cloths. For this reason it is made a contraband commodity; and the export made equally criminal with that of exporting wool. Abroad they make great use of urine instead of fullers' earth. Sir *H. Plat*, and others, reckon it a great improver of land. It promotes the growth of plants, as it abounds much in the vegative salt. When dissolved in vinegar it disperses pimples; it checks inflammations, and cures burns.

GEMS and PRECIOUS STONES.

GEM, is a common name for all precious Stones or Jewels.

DIAMOND, by the ancients called *Adamant*; a precious stone, the first in rank, value, hardness and lustre,

lustre, of all gems. The goodness of diamonds consists in their water, or colour, lustre and weight. The most perfect colour is the white. Their defects are veins, flaws, specks, &c. In Europe the *Lapidaries* examine the goodness of their rough diamonds by *day light*. In the Indies it is done by night. Dr. Wall, in the Philosophical Transactions, seems to have found an infallible method of distinguishing diamonds from other stones: A diamond, with an easy, slight friction in the dark, with any soft, animal substance, as the finger, woollen, silk, or the like, appears luminous in its whole body: and if you keep rubbing it long, and then expose it to the eye it will remain so for some time. Diamonds are only found in the East Indies, and that only in the kingdoms of Golconda, Visapour, Bengal, and the Island of Borneo. There are four mines, or rather two mines and two rivers. The miners work quite naked, except a thin linnen cloth before them, and they have also inspectors to prevent their concealing the stones, which however they frequently find means to do by swallowing them down when they are not observed.

CRYSTAL; a kind of fossil, transparent stone, white like a diamond, but much inferior in lustre and hardness. It is used for vases, urns, mirrors, &c. The ancients knew little of its nature. *Pliny* speaks of it as hardened, petrified water; but experience has shewn us the contrary. Several mountains of Europe, and some of Asia, produce *rock crystal*. Madagascar, is also said to yield more than all the world beside. Its perfection consists in *lustre* and *transparency*: that with straws, dust, clouds, &c. is little valued. It is frequently found hexagonal (or with six sides): the edges inimitably fine and accurate. It is cut and engraved in the same manner, with the same instruments, and by the same workmen as diamonds. *F. Francisco Lana*, in describing the *formation of diamonds*, observes, that in the Val Sabbia is a spacious round of a meadow, bare of all herbs, wherein crystals are generated all sexangular. The country people thought them produced from dews, because, being gathered over night, others would

arise in a serene and dewy sky. He observed that there was no mark of any mine thereabout, and concluded them produced by the *plenty of nitrous steams, which,* while it hindered the vegetation of those places, *might coagulate the dew falling thereon.* Rohault observes, that *crystal, diamond, &c.* must have been originally *liquid.* Boerhaave takes *crystal* to be the proper matter or basis of all *gems* or precious stones; and that they assume this or that colour from the different admixture of mineral fumes, &c.

Crystal is supposed useful in medicine as an astringent, that it increases milk in nurses, and is an antidote against arsenic.

RUBY; a red sparkling gem, of the first rank among precious stones. There are two places in the East Indies where the ruby is found; the kingdom of Pegu, and the Isle of Ceylon. There are rubies also found in Europe, particularly in Bohemia and Hungary, especially the former, wherein is a mine of flints of divers sizes, which, upon breaking, are sometimes found to contain rubies, as fine and hard as any of the eastern ones.

Rubies may be so nearly counterfeited, that the Lapidaries themselves may be deceived. When a ruby exceeds twenty carats it is called a **CARBUNCLE**, the name of an imaginary stone, described by the ancients. They long supposed the carbuncle to be taken from the dragon's head, and we hear of many a cavalier who went to combat with dragons, on purpose to gain this invaluable jewel. Vartoman assures us, that the king of Pegu used no other light in the night time, but that of his carbuncle, which cast a blaze like that of the sun.

The ancients credulously attributed many virtues to the ruby, as that it expels poisons, cures the plague, banishes sorrow, &c.

EMERALD; a precious stone, very green and transparent; in hardness next after the ruby. There are two kinds, *oriental* and *peruvian*.—The oriental is harder, more brilliant and transparent than the peruvian; which has generally clouds found in it, and sparkles less. Some, it is said, are found in Cyprus, and

and even in our own island; but they are very inconsiderable, if, indeed, there be any true ones at all.—The Emerald is supposed to grow more and more perfect in the mine, like the ruby, and to arrive at its greenness by slow degrees. The ancients made amulets of Emerald, against all kinds of sorcery; but we have now more experience, or less credulity, and they are valued for their beauty, not for their virtue. Some however suppose, when they are reduced into an impalpable powder, and mixed with rose-water, they may be of some use in medicine. Authors mention Emeralds of incredible magnitude; of one, pretended to have been seen by *Theophrastus*, in a temple in Egypt, four cubits long and three broad: and of an obelisk of emerald forty feet high.

TOPAZ; the third order of gems after the diamond. It is transparent and of a beautiful yellow or gold colour; it is very hard and takes a fine polish. It is found in the Indies, in Ethiopia, Arabia, Peru, and Bohemia. The oriental ones are most esteemed, their colour borders on the orange: those of Peru are softer, but their colour nearly the same. Those of Madagascar were in much esteem, but are now in small estimation.—The Topaz is easily counterfeited, and there are factitious ones, which to the eye do not appear inferior to the natural ones. The ancients ascribed great virtues to the Topaz which are now discredited. In the 118th Psalm there is mention made of the Topaz. It appears to be the true *Crysolite* of the ancients.

CHRYSOLEITE is a precious stone of a dusky green colour, with a cast of yellow. The ancients gave this name to all precious stones wherein the yellow or golden was the prevailing colour.

SAPPHIRE, or SAPPHYR. This precious stone is of an azure or beautiful sky-colour. It is transparent, yet so exceeding hard, as scarcely to bear being engraven. The deepest blues are esteemed males, and the whitest females. The finest things, in

the Hebrew, are all called Sapphires. The throne of God is said to resemble a Sapphire; and the Rabbins hold that Moses' rod, and the tables he received on mount Sinai, were of Sapphire.

The Chymists make several preparations of Sapphire, as a salt, a tincture, an essence, a water, an oil, &c. and there are few diseases but some pretend to cure by them.

Some rank the *cat's eye*, *oculus cati*, in the number of Sapphires. This gem has a remarkable diversity of colours, is very hard, and bears a polish equal to the true Sapphire. The Sapphires of Pegu are the most esteemed. They are found in the same mines with the rubies. Some are also brought from Calicut, Cananor, and Ceylon, from which last place we should be furnished with abundance, if the king of the island did not prohibit all commerce thereof with foreigners. —The soft water Sapphires of Bohemia and Silesia are of some account, though far inferior to the oriental ones, both in their brightness and firmness.

Some people value the Sapphire beyond the Ruby, and give it the second place among precious stones.

GRANATE, often called *garnet*, is a gem, or precious stone of a high red colour; thus called from the resemblance it bears to the kernel of a pomgranate. Granates are either *oriental* or *occidental*: the first are brought from divers parts of the East Indies; the second from Spain, Bohemia and Silesia. Those from the east are distinguished by their colour. Some are of a deep brownish red, as big as an hen's egg; others nearly of the hue of the hyacinth: a third kind have a mixture of the violet with their red. Of the *occidental* granates, those of Silesia are the darkest, and those of Bohemia the most valued. They are found near Prague, not in any particular mines, but are picked by peasants in the fields, from among the sand and pebbles.

AMETHYST; a precious stone, of a violet colour, bordering on purple. *Plutarch* says the amethyst takes its name from its colour, which according to him resembles wine mixed with water. The ancients supposed it prevented

prevented drunkenness, by being hung about the necks of great drinkers. The oriental kind, which is the hardest, scarcest and most valuable, is of a dove colour. The German is of a violet colour; and that of Carthage has the colour of a pansy. There are beautiful ones found in the Pyreneans, and in the mountains of Auvergne.

The amethyst is not extremely hard, and may be cut with a leaden wheel, smeared with emery, moistened in water. It is polished on a pewter wheel, with tripoli. It is easily engraven on, either in creux, or relievo.

BERYL denotes a transparent stone, or gem, brought from India, of a light or pale green colour. The beryl of the ancients is the same with what in latter times has been denominated *aqua marina*, on account of its azure or sea-green colour.

Some authors take the beryl to be the *diamond* of the ancients; this is certain—the ablest modern jewellers sometimes mistake the one for the other.

The beryl is sometimes found large enough to form fine vases. It is said there are many of them in Cambaya, Martaban, Pegu, and Ceylon.

The properties of the beryl were wonderful in the opinion of the ancient naturalists; it kept people from falling into ambuscades of the enemies; excited courage in the fearful, cured diseases of the eyes and stomach. It does none of these things now, because people are not simple enough to believe it has the virtue to do them.

AGAT or ACHAT; a precious stone, partly transparent, and partly opaque; usually diversified with a variety of colours, veins, spots, &c. sometimes exhibiting figures, or appearances of natural objects. There are various kinds of agat, which, according to their different colours, and degrees of transparency, have different names. The principal are these four, the *onyx*, the *calcedony*, the *black*, and the *German* agats. Agats have ordinarily reddish tints. *De Boet* mentions one of the size of a nail, wherein a bishop with his mitre was very well represented; and turning it a little, a man and woman's head were seen in its place. The Sardians

and Sardonic agats are very valuable; the latter is of a sanguine colour, and is divided into zones, which seems to have been painted by art. *Pliny*, *Strabo* and *Cicero* say that *Polycrates's* ring was a Sardonyx. Authors also speak of Roman Agats, Egyptian Agats, and others. The ancients mention a red agat spotted with points of gold, found in Candia, and called sacred. Agat has always been esteemed for seals; as being a stone that no wax will stick to. *Mr. Boyle* takes agats to have been formed of separate beds of strata of fine clay or earth, brought by a petrifying liquor to coagulate into a stone. He mentions an agat with a moveable spot, or cloud in it.

The ONYX, which is accounted a species of the opake agat, is a precious stone, of a dark horny colour, in which is a plate of a blueish white, and sometimes of red; the several colours appearing as distinct as if laid on by art. There are some brought from Arabia, mixed with a brownish hue; which after taking off one lay or zone, shew another underneath of a different colour. White zones or girdles are essential to an onyx.

The JASPER is a sort of precious stone, chiefly opake, but sometimes transparent in certain parts, not much different from the agat, excepting in this, that it is softer and does not take so good a polish. The florid jasper found in the Pyreneans, is usually stained with various colours. The most beautiful is that bordering on the colour of lacca or purple; next to that, the carnation; but what is now most valued is the green spotted with red. In some jaspers, nature seems to have amused herself in representing rivers, trees, animals, landscapes, &c. as if they were painted.

OPAL; a precious stone of various colours; changeable according to the different positions of the stone to the light. In it are seen the red of the ruby, the purple of the amethyst, the green of the emerald, besides yellow, blue, and sometimes black and white. When the stone is broken most of these colours disappear, which shews that they arise by reflection from one

or

or two principal ones. Its form is always either round or oval, like a pearl; its prevailing colour white. Its diversity of colours makes it almost of equal value with a sapphire or ruby. *Tavernier* says, there are mines of opal in Turkey. Others, say Cyprus, Arabia, Egypt, Bohemia, and Hungary produce it; whence it is distinguished into two kinds, *oriental* and *occidental*. *Pliny* and *Solinus* mention a species of opal called *exacantalithus*, which had sixty colours. There is an artificial opal, counterfeited so as nearly to represent the natural stone.

CORNELIAN, or CARNELIAN; a precious stone, ordinarily red, bordering on orange; called also *Sardius*, or the *Sardian stone*. It is but little transparent, cuts easily; and we find most of the fine grayings of antiquity, whether in *relievo*, or indented, are on this stone. It bears the fire admirably. The finest cornelians are those brought from near Babylon; the next are those of Sardinia; the last, those of the Rhine, Bohemia, and Silesia. To give these stones a greater lustre, in setting them they lay a piece of silver leaf underneath. The principal use made of cornelians is in seals, as they grave well, and take a fine polish.

HYACINTH, or JACINTH; a precious stone, so called from its resemblance to the purple flower named hyacinth, or the violet. This, it must be observed, agrees with the ancient, rather than the modern hyacinth, which is usually of a deep reddish yellow, approaching a flame colour, or the deepest amber. There are four sorts of hyacinths, distinguished by their colour; and they are also distinguished into *oriental* and *occidental*. The *oriental* come from Calicut and Cambaya, and are equal in hardness to the *oriental amethyst*. The *occidental* are found in Bohemia and Portugal, which are a degree softer. The stone graves or cuts fine, and would be more used for seals, but that the graving frequently costs more than the stone. The ancients used it for amulets and talismans; and bore it about their necks, or set in rings, &c. supposing it to have the virtue of securing them from the plague.

The

The hyacinth used in medicine, and whereof the confection of hyacinth is made, is a different stone, of which there are three several sorts.

PEARL; a hard, white, shining body, usually roundish, found in a testaceous fish, resembling an oyster. It is ranked in the number of gems, or precious stones. The fish wherein the pearls are found is three or four times the size of the common oysters; and is called by naturalists, *pinna marina*.

Each pinna commonly yields ten or twelve pearls, though an hundred and fifty, it is pretended, have been seen in the same fish. Some among them are much larger than others and ripen faster. The most perfect drop first, the rest remaining at the bottom of the shell. Some grow so big as to hinder the oyster from shutting, in which case the fish rots and dies.

The formation of pearls has puzzled both ancient and modern naturalists. Pliny supposes them formed of the dew. The fish, says he, rises every morning to the surface of the water and there opens its shell to imbibe the dew of the heavens, as some liquors are converted into crystals in the earth; or as the juice of flowers into honey and wax in the body of the bee, so the dew like a liquid pearl, insinuating into the body of the fish, fixes its salts, and there assumes the colour, hardness, and form of pearl. But this, how plausible soever, is apparently false, for the pearl oysters grow fast to the rocks, and no body ever yet saw any of them appear on the surface of the water. Some think pearls to be the eggs of the fishes they are found in: but neither does this agree with the phenomena, for pearls are found throughout the whole substance of the oyster, in the head, the coat that covers it, the circular muscles that terminate in it, the stomach, and other parts.

M. Reaumur has a very curious piece on the subject of their formation. He observes that pearls are formed like other stones in animals, as those in the bladder, kidneys, &c. that they are apparently the effects of a disease in the fish, that they are formed of a juice extravasated out of some broken vessels, and detained and fixed among the membranes. He observes that the shells of

sea

sea fishes, as well as those of snails, &c. are formed of a glutinous, stony matter, oozing out of the body of the animal, and it is no wonder that an animal which has vessels wherein circulates a sufficient quantity of stony juice to build, thicken, and extend a shell, should have enough to form stones, if the juice should happen to overflow and burst forth into any cavity of the body, or among the membranes.

Pearls are caught in the seas of the East Indies—in those of America—and in some parts of Europe, as on the coast of Scotland, and in a river of Bavaria.

STONES.

All stones are hard, solid bodies, neither malleable, nor fusible by fire, nor soluble in water; formed in succession of time in the body of the earth.

For the *origin and formation of stones*, M. Tournefort in 1702, proposed to the Royal Academy a new theory.—On a curious survey of the famous labyrinth of Crete, he observed that several people had engraven their names in the living rock, whereof its walls are formed,—and that the letters, instead of being hollow (being all cut with knife points) were prominent and *stood out* of the substance of the rock, like so many basso-relievos. He thence concluded that, the cavities of the letters filled insensibly, with a matter, issuing out of the substance of the rock, and that even in a greater abundance than was necessary for filling the cavity. Thus is the wound made with the knife healed up; the *matter* of the letters was whitish, and the rock greyish. Something very like it is observed in the barks of trees, wherein letters have been cut with a knife; so that the Poet had reason to say, *crescent illa, crescetis amores*.

M. Tournefort, from this and other instances, supports his opinion, that there are stones which grow in the quarries, and consequently that are fed; that the same juice which nourishes them serves also to join their parts when broken, just as in the bones of animals

mals, and the branches of trees, when kept up by bandages ; and in a word he believes that they vegetate. There is indeed, no room to doubt but that they are organized, and that they draw their nutritious juice from the earth.—That some stones at least vegetate and grow like plants is clear, and probably they are generated in the same manner.—None ever doubted that shells grow by means of a nutritious juice ; and yet this juice is conveyed along the narrow canals of these excessively hard bodies. Stones, therefore, though hard, may vegetate.

Having already spoken of Precious Stones, we shall notice the more common kinds ; as Marble, Porphyry, Alabaster, Portland-stone, &c.

MARBLE ; a valuable kind of stone, found in great masses, dug out of pits or quarries : being of a constitution so hard and compact, and again so fine as readily to take a beautiful polish ; much used in ornaments of buildings, as columns, statues, altars, tombs, chimney-pieces, tables, and the like.

There are an infinite number of different kinds of marble, usually denominated either from their colour, their age, their country, their grain, their degree of hardness, their weight, or their defects ; some are of one simple colour, as white, or black ; others streaked or variegated with stains, clouds, waves, veins, &c. but all opaque except the white, which, when cut into thin slices, becomes transparent.—*English white marble* is veined with red. *Derbyshire marble* is variously clouded, and diversified with brown, red, yellow. *Marble of Auvergne*, in France, is of a pale red, mingled with violet, green and yellow. Various other kinds are denominated by the places from which they are brought, as *Dinan*, near Leige.—*Namur*, *Languedoc*, *Savoy*, *Sicily*, &c. &c.

Artificial Marble, is only marble pulverized, and mixed in a certain portion with plaster ; the whole well sifted, worked up with water, and used like common plaster. With this stucco, are made statues, busts, basso-relievos, and other ornaments of architecture.

To *polish marble*, it is first rubbed with freestone; afterwards with pumice-stone, and last with emery, or calcined tin.

PORPHYRY; a precious kind of stone, or marble, of a brownish red colour, frequently interspersed with white stains; anciently brought from *Egypt*, and exceeding all others in hardness. The porphyry quarries are long since lost, and the art of cutting it, among the ancients, is also lost. The modern tools will scarcely touch it. Either the ancients, therefore, had the art of tempering steel better than we, or they had the art of softening the porphyry. Though it is probable that time and air have contributed to increase its hardness.

Mr. *Addison* tells us he saw a workman at Rome employed in the cutting of porphyry, but his advances were exceedingly slow, and almost insensible. The *Italian Sculptors* work it with a brass saw without any teeth, together with emery and water. *Leon Baptista Alberti*, searching for the necessary temper, says he found goat's blood the best of any. *Cosmo de Medicis* is said to have distilled a water from certain herbs, wherewith his sculptor gave his tools such an admirable hardness and temper, as that he performed some fine works with them, particularly our Saviour's head, in demi-relievo. Even the very hair, and beard, how difficult soever, are here well conducted, and there is nothing of the kind better in all the works of the ancients. But the secret seems to have died with him.

The French pretend to have found another method, with an iron saw without teeth, and freestone pulverized with water.

ALABASTER; a species of that genus of stones, whose base is calcareous earth. It differs from Marble in being combined, not with the ærial, but with vitriolic acid. In its composition it does not differ from Plaster of Paris.

There are three kinds; the snow-white, shining alabaster, found in Taurus, in pieces large enough to make dishes: it cuts freely and is capable of a fine polish.

2d. the yellow alabaster, is found in Greece, of a soft texture, heavy and nearly of the colour of honey. This species has been found also in Germany, France, and in Derbyshire, in England. 3d. the variegated, yellow and reddish alabaster. This is the common alabaster of the ancients, and is so soft that it may be cut with a knife, it is remarkably bright, almost transparent; admits of a fine polish, and consists of large angular sparry concretions.

Alabasters are frequently used by statuaries for small statues, vases and columns. The clearness and fineness of this stone renders it in some measure transparent, whence it has been sometimes employed for windows. There is a church at *Florence*, still illuminated by alabaster windows; instead of panes of glass there are slabs of alabaster near fifteen feet high, each of which forms a single window, through which the light is conveyed. The countries in Europe which abound most in alabaster, are Germany, towards Coblenz; the province of *Macconnois* in France; Italy towards Rome and in *Lorrain*. A new manufacture of basso-relievos, from a singular species of fastitious alabaster, has been some time ago established by *M. Letapie*, at the baths of *St. Philip* in *Tuscany*. The stream of these baths deposits a peculiar kind of sand, which when collected and condensed, in the cavities of any body employed to oppose its current, acquires the nature, hardness and colour of alabaster, and assumes the forms of those cavities in which it is thus lodged.

FREESTONE; that dug in the peninsula of *Portland*, and thence called *Portland-stone* is much used, being softer and whiter than *Purbec stone*, and is commonly raised out of the quarries in bigger blocks than that. Some also call *Ryegate* or *fire stone*, free-stone.

Mr. Boyle observes that a competent knowledge of the sap or juice found in stones used in building is of great importance. The same stone dug out of the same quarry at one season, being found to moulder away in a few winters, which dug at another season, will brave the weather for many ages: and there are others though
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dug at a proper season, yet make but ruinous buildings if used at an improper season. The same author adds, that as there are some sort of stones, which will decay in a few years, there are others that will not have attained their full hardness in thirty or forty years, or even much more.

Freestone, is a whitish stone, dug up in many parts of England, that works like alabaster; but more hard, and durable, being of excellent use in building. It is a kind of *greet* but finer sanded, and a smoother stone; and is called freestone from its being of such a constitution as to be cut freely in any direction.

SLATE; a blue fissile, very soft when dug out of the quarry, and on that account easily cut or sawed into thin, long squares, to serve in lieu of tiles, for the covering of houses: Sometimes also to make tables of, and to pave with, and for other purposes. The ancients were unacquainted with the use of slate, and instead thereof covered their houses with shingle as we read in *Pliny*. Besides the blue slate, we have in England a greyish slate, called also Horsham-stone from a town in Suffex of that name, where the greatest quantities of it are found. The blue slate is a very light, lasting and beautiful covering. To judge of the goodness of slate, Mr. *Coleprests*, in the Philosophical Transactions, orders it to be knocked against any hard body, to make it yield a sound; if the sound be good and clear, the stone is firm and good. Another method of proving its goodness is by weighing it exactly, then letting it lie six or eight hours under water, and wiping it very clean; if it weighs now more than it did before, it will not endure without rotting the lath or timber.

FLINT; a small, hard, black pebble; chiefly used for yielding sparks of fire by collision against steel.

The Indians, instead of steel and flint, use two pieces of green wood, which they rub violently against each other. In the East they use the wood *candon*, and in Peru, *reyaca*.

Flints are also one of the principal ingredients in the making of glass.

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PUMICE

PUMICE-STONE; a kind of spongy stone, very porous and friable. Naturalists are not agreed about the nature and origin of pumice. Some think it to be a piece of rock half burnt and calcined, cast up in eruptions of volcanos, particularly *Ætna* and *Vesuvius*, into the sea. Dr. *Woodward* considers pumice as only a sort of slag or cinder; and affirms it is only found either where forges of metal have anciently been, or near some volcano, or burning mountain. Other authors will have it to arise from the bottom of the sea; whence they suppose it to be detached by subterranean fires; and hence account both for its lightness and porosity, and its saline taste, alledging that several parts of the *Archipelago* are frequently found covered with it, all at once, after a few inward shakes and heavings of the bottom of the sea.

Pumice makes a very considerable article in commerce, and is much used in the arts and manufactories, to polish and smooth several works. The marblers and parchment-makers use the largest and lightest—the curriers the heaviest and flattest—pewterers the smallest.

HONE; a fine sort of whet-stone, whereon to set a razor, or penknife. It is of a yellowish colour, being holly-wood petrified, or changed into stone, by lying in the water for a certain season. Some in *Oxfordshire* are said to be thus petrified in a very short time.

OF COLOURS AND PAINTS.

The following descriptions of some of the colours used in painting, may not be unacceptable to young gentlemen and ladies who learn drawing: They will discover what are produced from minerals, what from earths and stones, and what are extracted from vegetables. It will show them what kinds are of an innocent, and what of a poisonous quality, and serve as a caution in the use of them.

CINNABAR;

CINNABAR ; a mineral stone, red, heavy, and brilliant ; found chiefly in the quick-silver mines. The *common vermilion* is nothing else but cinnabar, ground up with spirits of wine and urine. Cinnabar is either *native* or *factitious*. Native or mineral cinnabar, which is that above mentioned, though found among quicksilver, has mines of its own. Those in Spain are very famous. The French too have theirs in Normandy. Each pound of good cinnabar yields fourteen ounces of mercury. The Alchymists say it is disposed for attaining to the transmutation of gold. *Factitious* or artificial cinnabar, is formed of a mixture of mercury and sulphur, sublimed, and thus reduced into a kind of stone. The best is of a high colour, full of fibres. This is used by farriers to make pills for their horses ; and by painters as a colour ; it being a very vivid *red* ; but drying with some difficulty. This cinnabar is rendered more beautiful by grinding it with gum water, and a little saffron : those two drugs preventing its growing black.

VERMILION ; a bright, beautiful red colour, in great esteem among the ancients, under the denomination of *minium*. The *artificial* or *factitious* vermilion is made of mineral cinnabar, described above. The *natural* is found in some silver mines, in the form of a ruddy sand, which is prepared and purified for use. We have two kinds of vermilion from Holland, the one of a deep red, the other pale ; the difference of colour only proceeding from the cinnabar being more or less ground.

This is of considerable use, among the painters in oil and miniature ; and likewise among the ladies, as a fucus or paint, to heighten the complexion. Among the ancients, the images of the gods were painted with vermilion on the feast days ; and their generals on the days of triumph.

RED LEAD ; a preparation of mineral lead, calcined and rubified ; used by painters, potters, and physicians. This seems to be the real *minium* of the ancients, which was a preparation of lead, performed by fire.

WHITE LEAD, used by painters, is only thin plates of lead, dissolved with vinegar. Every ten days the *rust* formed on the surface is scraped off, and again steeped, and scraped till the whole be quite consumed.

Of this *white-lead* it is that the paint, used by the ladies, called *ceruse*, is made.

White-lead is somewhat dangerous both in the grinding and using, as being a rank poison.

BLUE is one of the primitive colours.

In limning, miniature, &c. the painters use *ultra-marine blue ashes* and *smalt*. In oil and miniature they use indigo, blue bice, blue verditer, lapis armenus, smalt, also a counterfeit ultramarine.

Dyers' Blue is one of their simple or mother colours, used in the composition of others. It is given chiefly with *woad* and *indigo*.

WOAD; called also GLASTUM, arises from a seed sown annually, in the spring, which puts forth a plant called *glastum sativum*. They have usually three, four, or five crops of leaves every year, but only the *two* or *three first* are of value; whereof the first is best, and the rest in their order. When the leaves are ripe they gather them, and letting them lie sometime, put them under the wheel to bruise or grind them; after which they are laid eight or ten days in piles or heaps; and at last reduced into a kind of balls, which are laid in the shade, on hurdles, to dry. This done, they break or grind them to powder; and, when ground, spread the whole on a floor, and water it. Here they let it smoke and heat, till by torrifying it every day it becomes quite dry, which they call *silvering*. A week, or more, after which, it is in a condition to be used for *dying*.

The *ancient Britons* used to dye their bodies herewith; and some hold that it was from this plant, called *glastum*, that *gläs* took its denomination; though others derive both *gläs* and *glastum* from the British *glas*, which signifies a *blue* colour.

A woad blue is a very deep blue, almost black; and is the base of so many sorts of colours, that the dyers have

have a scale, whereby they compose the divers casts, or degrees of woad, from the brightest to the deepest.

INDIGO is a deep blue, brought from the West Indies. It is drawn from the leaves of a plant which the Spaniards call *anil*, and we *nil*, *Indian wood*, and *Indigo*.

When the plant has arrived at a certain height, and its leaves are in a good condition, they cut them down, and throw them into a vat, covering them with water, at the top swims a scum, with all the different colours of the rainbow. Then the water is let off into another vessel, where they agitate and churn it, with five or six long poles, fitted together for that purpose. This they do till the water appears of a deep green, and till the grain, as they call it, forms itself, which they discover by taking a little of it into another vessel, and spitting in it, for then, if they perceive a bluish dreg subsiding, they cease to beat. The matter then precipitates to the bottom of a vessel, after which they pour off the water. It is then put into little linen bags to drain, and, when dry, it is cut into slices, and hardened in the sun.

There are several kinds of indigo. That is thought to be the best, which is in flat pieces, of a moderate thickness, pretty hard, clean, light enough to swim in water, inflammable, of a fine blue colour, marked a little on the side with silver streaks, and appearing reddish when rubbed on the nail.

Indigo is used among painters, who grind it and mix it with white to make a blue colour, for without that mixture it would paint blackish. It is mixed with yellow to make a green colour.—It is also used in dying,—and by the *laundresses* to give a bluish cast to their linen.

Indigo is of good use in drying of tumors, or risings and swellings of any part of the body.

SMALT; a *mineral* matter, prepared and purified abroad and brought hither sometimes in the form of a blue powder, and sometimes in cakes; chiefly used along with starch to give linens a finer and clearer cast; and best known by the name of *stone* or *powder-blue*.

In the *Philosophical Transactions*, we find the preparation of it described by Dr. *Krieg*, who tells us that it is made of the mineral stone, called *cobalt*, or *cadmia*, which being pulverized and the lighter stuff washed away, the remainder is laid on a furnace, and by the heat a matter is separated from it in the form of smoke, which sticking to the walls makes what we call *arsenic*. When the cobalt has done smoking, it is cooled, mixed with pot-ashes and powder of white flint stones, the mixture is put in pots, and melted for five or six hours in a furnace, by this means the matter is formed into a blue glass, which being put into cold water, cracks and grows tender and is at length powdered by an engine; the finest part separated by a sieve, put into a mill and ground in water into the finest powder, which by washing is still separated from the coarser, then dried in warm chambers, barrelled up and sent away.

BLUE VERDITER, is a *bright blue*. It works easy with water. It is somewhat inclining to a green, and it is the blue which is most of all mixed with yellow berries.

Next to ultramarine, **BLUE BICE** is the most excellent, and is often made to serve instead of it. It works much better than smalt.

ULTRAMARINE; a beautiful *blue* colour, used by the painters, prepared from *lapis lazuli*. This is a sort of precious stone, called also *azure* stone. It is found in mines of gold, silver, and copper, as also in pits of marble, which last is that generally in use.

The *Armenian stone* bears a near resemblance to *lapis lazuli*. *Boerhaave* ranks it among semi-metals, and supposes it composed of a metal and earth.

RED is one of the five simple or mother colours.

MADDER, a *red*, bitter astringent root, of a plant called *Rubia tinctorum*; much used by dyers, to give a strong, rich, red colour.

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It is useful in *medicine*, being found of service in obstructions of the bowels, and in an ill state of the humours of the body. It is generally made up in form of decoctions, diet drinks, and medicated ales.

COCHINEAL; a drug used by the dyers, for giving red colours, especially crimsons and scarlets.

It comes from the West Indies. Some say it is a kind of worm, others the berry of a tree. *F. Plumier*, a celebrated botanist, has maintained the former opinion, and *Pomet* the latter. But, it seems, that there is cochineal which is a worm, and another a seed. *Dampier* has given a description of each kind. He says, the cochineal worm is an insect engendered in a fruit resembling a pear; the shrub that bears it is five or six feet high. On the top of the fruit grows a red flower, which, when mature, falls on the fruit; and that opening discovers a cleft two or three inches in diameter: The fruit then appears full of little red insects, having wings surprizingly small; and which would continue, and die, and rot there, if not taken out. The Indians, therefore, spread a cloth under the tree, and shake it with poles, till the insects are forced to quit their lodging, and fly about the tree, which they cannot do many moments, but tumble down dead into the cloth; where they are left till entirely dry. When the insect flies, it is red, when fallen, black; and when dry, white, though it afterwards changes colour. There are whole plantations of the cochineal tree in the kingdom of Mexico.

The cochineal grain, or, as *Dampier* calls it, *sylvestris*, is a red berry, growing in America, found in a fruit resembling that of the cochineal tree. The first shoots produce a yellow flower; then comes the fruit, which is long, and when ripe, opens with a cleft of three or four inches. The fruit is full of kernels or grains, which fall on the least agitation, and which the Indians take care to gather. Eight or ten of these fruits will yield about an ounce of grain. This berry yields a dye almost as beautiful as that of the insect, and a person may easily be deceived in them, though the other is much the more esteemed.

CARMINE;

CARMINE ; a bright *red* or *crimson* colour, bordering on purple, used by painters in miniature. It is rarely used in oil, on account of its price.

Carmine is the most valuable product of the cochineal melleque, which is a sediment, at the bottom of the water, wherein is steeped cochineal couan and autour, some add rocou, but this gives the carmine too much of the orange cast. To be good it must be almost an impalpable powder ; that is, a powder scarcely perceptible by the touch.

Some make carmine with brazil wood, fernambouc, and gold leaf, beat in a mortar, and steeped in white wine vinegar ; the scum arising from this mixture upon boiling, when dried, makes carmine ; but this kind is much inferior to the former.

LAKE or **LACCA** ; the red that is called *artificial* is made of brazil wood, boiled in lye, made of the branches of the vine, or, as it is otherwise expressed, brazil wood boiled in a *lixivium* of the branches of the vine, adding a little cochineal, terra-merita, calcined allum, with the bones of the cuttle fish-pulverized, and made up into little cakes, and dried.—If to make it *very red*, the juice of citron is added, and if *brown*, oil of tartar.

Artificial Lacca is a name given to a coloured substance, drawn from several flowers ; as the yellow from the flower of the juniper, the red from the poppy, &c. the blue from the iris or violet.

Lacca, if natural, is also a sort of gum, or rather wax, hard, *red*, brittle, clear, and transparent, brought from Malabar, Bengal, and Pegu, and it is used in dying scarlet, painting, &c.

Tachard says, that a kind of little ant, fixing themselves on the branches of several trees, leave behind them a reddish moisture, which, lying exposed to the air and the sun, hardens and becomes lacca. Some imagine that this is not the production of the ants, but a juice which they draw out of the tree, by making little incisions in it ; and indeed the trees where the lacca is found do yield a gum, though of a very different nature to the lacca. Others say, the ants act here in quality
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of bees, and the lacca is their honey. *Lemma* having examined the gum lacca chymically, supposes it to be a mean mixture between a gum and a resin. *Geoffroy*, examining it, found it to be a kind of comb, such as the bees and some other insects are accustomed to make. Upon breaking it into pieces, it appears to be divided into a great number of *alveoli*, or little cells of an uniform figure, and which plainly shew that it never oozed from trees. These cells are found to contain little bodies in them, which are of a beautiful red colour, and make a powder as fine as cochineal. It is most probable, these cells are destined to lodge the young brood, as those of the bees, and that these little carcasses are the embryos of insects.

There are *several kinds of lacca*, which accounts for these different descriptions.

KERMES ; a kind of husk, or excrescence, resembling a berry, growing on an evergreen of the oak kind, of considerable use both in *physic* and *dying*.

That which is sometimes called by the French, *Vermillon*, or *grain de gall*, or *vermeil*, is a kind of nest of an insect, about the size of a juniper-berry, round, smooth, and glossy ; of a *beautiful red* colour, and full of a juice of the same dye ; found sticking to the bark, on the stem and branches of a sort of scarlet oak, growing in Spain, Languedoc, and other hot countries. The kermes-berry is of a vinous smell, a bitter, though agreeable taste, and its pulp, or juice, full of numerous minute ova of animalcules.

The origin of the kermes is supposed owing to a little maggot, which, pricking the ilex to deposit its eggs, raises a little tumor or blister, which fills with juice, and as it ripens, becomes red. Hence, when kermes is dried, there comes out of it an infinite number of little insects, and flies, so small that they are scarcely sensible, insomuch that the whole substance seems converted into them. To prevent this inconvenience they usually steep the kermes in vinegar before it be dry.

They draw the juice or pulp from the kermes by pounding it in a mortar, and straining it through a sieve.

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Of this they make a syrup, by adding a sufficient quantity of sugar.

The kermes-grain is of great use in *physic*, it fortifies the stomach, &c.—There is a celebrated confection called Al-kermes. It is however of greater use in dying *scarlet*. According to *M. Marfigli's* experiments made at Montpellier, the kermes berry has the effect of galls, when mixed with vitriol making ink, and mixed with lime water, it makes a crimson.

YELLOW is one of the five simple and mother colours.

TURMERIC; a medicinal *root*, used likewise by the dyers, to give a yellow colour. It is not unlike ginger, either in *figure* or *size*. It is yellow both within and without side, and very hard.

Madagascar yields it; and it is also brought from the East and West Indies. Choose that which is resinous, new, hard to break, heavy and big. The yellow root, as it grows old, turns brown, and for want of attending to this, some have supposed, that the red and brown were of different kinds.

It is much used by the glovers, to dye their gloves; and by founders to give a good colour to brass. The Indians use it to dye their rice, and other foods, of a yellow colour; whence some call it Indian saffron.

Our dyers do not find that it gives so steady a yellow as the luteola or weld; but it is admirable to brighten and heighten the red colours died with cochineal or vermillion, as scarlets, &c.

Turmeric is used in *medicine* by way of decoction, infusion, powder, &c. It is held a sort of specific in the jaundice and dropsy.

WELD; a *plant* used by dyers to give a yellow colour. It is much cultivated in Kent for the use of the London dyers. With the help of potashes, it yields a deep lemon colour. It serves to dye all colours, between white and a deep yellow; and its dye will hold well.

For the *finest* yellows, dyers first boil the cloth or stuff in allum and potashes; then give the colour with weld or would.

SAFFRON; a plant which produces a flower of the same name; whence also a drug called saffron, or *crocus*, is gathered.

The root which produces the saffron, is a kind of bulb, or onion, covered with several bulbous cartilages: its leaves are long. From the middle of the flower arise three long flame-coloured filaments, and these are properly the saffron; the rest of the flower being of no use. Five pounds of fresh filaments make one pound of dry saffron. The best saffron in Europe is that of England: that brought from Spain is good for nothing, because of the oil which they mix with it to make it keep.

Saffron is used both in food and medicine, to cheer, fortify and resolve.—It is the greatest cordial in medicine. It is also used by illuminors, to make a golden yellow colour,

GAMBOGE is a concreted vegetable juice, partly of a gummy, and partly of a resinous nature. It is chiefly brought to us in large cakes or rolls, from Cambaja in the East Indies. The best sort is of a deep yellow or orange colour, breaks shining and free from dross: it has no smell, and very little taste, unless kept in the mouth for some time, when it impresses a slight sense of acrimony. It immediately communicates to spirit of wine, a bright golden colour, and almost entirely dissolves in it; *Geoffroy* says, except the sixth part.

It makes a beautiful yellow, and is much used by painters. Dr. *Lewis* says, that it makes a beautiful and durable citron yellow stain upon marble, when rubbed in substance upon the hot stone.

As a medicine, gamboge evacuates powerfully, both upwards and downwards. *Geoffroy* says, he has given from four to eight grains, without violence. He recommends it to be taken with an equal quantity of vegetable alkali for the tape worm.

OKER is a yellow kind of earth, used by painters. Some say, it is a semi-metal, under which head it has been described.

SPANISH BROWN is an earth, dug out of the ground. Among painters it is used as the first and priming colour. It works well if ground fine. In choosing good, that which is freest from stones, and of the deepest hue is the most esteemed. For many purposes it requires to be burnt.

RUDDLE; a sort of dusky red chalk, or earth, found in divers parts of England, chiefly in iron mines. It is called by the ancients *hamatides*. *Pliny* reckons five kinds. That commonly used by painters is factitious, being made of Armenian bole, and other drugs. The native or fossil kind comes from Egypt, Bohemia, &c. The gilders use it for burnishers to polish their gold with. *Bauschius* has an express treatise on this stone.

BLACK; something opaque and porous, that imbibes all the light falling thereon, reflects none, and therefore exhibits no colour.

There are various kinds of blacks. The dyers when they are to dye cloths, &c. black, first dye it blue, with woad and indigo, and the black is given afterwards with galls, copperas and sumac.

There is what is called Jesuit's black, which dye black without first dyeing blue. It is said to have been invented by Jesuits, and to be still practised in their houses. There is a *German black* made with ivory and peach-stones burnt, mixed and ground with lees of wine burnt.

IVORY BLACK is made of ivory burnt between two crucibles well luted; which, being thus rendered perfectly black, is ground in water, and made into little cakes.

LAMP-BLACK is the sooty fumes of rosin, prepared by melting and purifying the rosin in iron vessels, then setting fire to it under a chimney, or other place,
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lined with sheep skins, or thick linen cloth to receive the vapour or smoke, which is the *black*. It is sometimes prepared from the resinous parts of woods, burnt under a kind of tent, which receives it. Of this kind we have much from Sweden and Norway. This black takes fire very readily.

SPANISH BLACK is so called because first-invented by the Spaniards, and most of it brought from them. It is no other than *burnt cork*: used in various works, particularly among painters.

There are several colours that require burning, as first, **LAMP-BLACK**, which is of so greasy a nature, that, except it be burnt; it will require a long time to dry. The method of burning, or rather, drying lamp-black, is as follows: Put it into a crucible, over a clear fire, letting it remain till it be red hot, or so near it that there is no manner of smoke arising from it.

Secondly, **UMBER**, which, if it be intended to be a shadow for gold, &c. then burning suits. In order to burn umber, you must put it into the naked fire in large lumps, and not take it out till it be thoroughly red hot; or, if you wish to be more curious, put it into a crucible, and make it red hot.

IVORY also must be burnt to make black, thus, fill two crucibles with shavings of ivory, then clap their two mouths together, and bind them fast with an iron wire, and lute the joints close with clay, salt and horse dung, well beaten together; then set it over the fire, covering it all over with coals; let it remain on the fire, till you are sure that the matter inclosed is thoroughly red hot; then take it out of the fire, but do not open the crucibles till they are perfectly cold; for, were they opened while hot, the matter would turn to ashes; and so it will if the joints are not luted close.

BISTER, or **BISTRE** is made of chimney-foot boiled, and afterwards diluted with water; serving painters to wash their designs.

INDIA INK, or *Chinese Ink*, is an admirable composition, in vain attempted to be imitated in Europe. It is not fluid like our writing ink ; but solid like our mineral colours, though much lighter. They make it of all figures, but the most usual is the rectangular, about a quarter of an inch thick. Some of the sticks are gilt with figures or dragons, birds, flowers, &c. In order to this they have little wooden moulds, so curiously wrought, that we could hardly equal them in metals.

The Chinese make this ink with smoke-black of different kinds, but the best is said to be made of the smoke of fat pork, burnt at a lamp. They mix a kind of oil with it to make it more smooth, and add other odorous ingredients, to take away the rankness of the smell. After they have mixed it into a paste of a proper consistence, they put it into a mould to figure it.

We shall close this head of Paints and Colours with a short description of India Rubber, that most generally useful substance among learners, in drawing.

INDIA RUBBER, or *Elastic Resin*, is a substance produced from the *syringe-tree* of *Cayenne* and other parts of South America, and possessed of the most singular properties. No substance is yet known which is so pliable, and at the same time so elastic ; and it is farther a matter of curiosity, as being capable of resisting the action of very powerful *menstrua*. *M. de la Condamine* says it oozes out, under the form of a vegetable milk, from incisions made in the tree ; that it is gathered chiefly in time of rain, because it flows then most abundantly. The means employed to inspissate and indurate, *M. de la Borde* says, are kept a profound secret. By inspissate is meant to thicken, and by indurate to harden, which *M. Bomare*, says it does gradually, by being exposed to the air. The Indians make books of it, which water cannot penetrate, and which when smoked have the appearance of real leather. Bottles are also made of it, to the necks of which

which are fastened to hollow reeds, so that the liquor contained in them may be forced through the reeds or pipes, by pressure. One of these filled with water is always presented to the guests at their entertainments, who never fail to make use of it before eating. Flambeaux, an inch and a half in diameter and two feet long, are likewise made of this resin, which give a beautiful light, have no bad smell, and burn twelve hours. A kind of cloth is also prepared from it, which the inhabitants of Quito apply to the same purposes as our oil-cloth and sail-cloth. It is formed, by means of moulds, into a variety of figures for use and ornament. The process is said to be thus: The juice, which is obtained by incision, is spread over pieces of clay formed into the desired ornamental shape; and as fast as one layer is dry, another is added, till the whole be of the proper thickness. It is then held over a strong smoke of vegetables on fire, whereby it hardens into the texture and appearance of leather, and before the finishing, while yet soft, is capable of receiving any impression on the outside, which remains ever after.

Many attempts have been made to dissolve it, so as to make it assume different figures, with equal ease as when it was in its original state, running from the tree. Mr. *Macquer* tried oils, turpentine, spirits of wine, the milky juice of other vegetables, heat, &c. but none of these was capable of dissolving it. At last he tried *ether*, which perfectly dissolved it, without any other heat than that of the atmosphere. It was then transparent and of an amber colour.

A resin similar to this was discovered some years ago by Mr. *Poivre*, in the isle of France. Some kinds of this Gum, have been dissolved by other methods.

HARD WOODS, &c.

Some woods are valued on account of their curiosity, as Ebony, Box, Calambo, Cedar, &c. which, by reason of their extraordinary hardness, beautiful polish, or agreeable smell, are made into tables, combs, beads, &c.

EBONY is brought from the Indies; it is exceedingly hard and heavy, and capable of a very fine polish; and on that account it is used in inlaid works, toys, and Mosaic. *Mosaic works* are an assemblage of marble, shells, stones, glass, &c. of various colours, cut square and cemented; or inlaid. This is sometimes done with wood, and the ancients were used to adorn their richest furniture with a mosaic of ivory, ebony, and the finest woods.

Of *ebony* there are divers kinds, black, red, green, &c. all of them the product of the Island of Madagascar. The Island of Maurice likewise, furnishes part of the ebony used in Europe.

M. Flacourt, who resided in Madagascar as governor, assures us that it grows very high and big; its bark black, and its leaves resembling those of our myrtle, of a deep, dusky green colour.

Tavernier assures us, that the islanders take care to bury their trees, when cut down, to make them the blacker. *F. Plumier* mentions another black ebony tree, discovered by him at St. Domingo. Candia also bears a little shrub, called *ebenus cretica*.

Pliny and *Dioscorides* say, the best *ebony* comes from Ethiopia, and the worst from India: *Theophrastus* prefers that of India. The best ebony is a jet black, free from veins and rind, very heavy, and of a sharp pungent taste. Its rind will cure some disorders. Ebony yields an agreeable perfume when laid on the coals; and when green it readily takes fire from the abundance of its fat. The Indians make statues of their gods, and sceptres for their princes of this wood.

Green ebony grows in Madagascar, St. Maurice, and the Antilles, and especially in Tobago: this is used in dyeing, and yields a fine green tincture. Of *red ebony*

we know but little. Cabinet-makers, inlayers, &c. make pear tree and other woods pass for ebony, by washing it with a hot decoction of galls, &c.

BOX is of long duration. Its wood is extremely hard and smooth, and therefore well adapted to the use of the turner. Button moulds, knife-handles, combs, and mathematical instruments are made of it, and it may be very properly substituted in default of ebony.

The following account of the efficacy of box-wood, in making the hair grow, is in the *ephemerides* of the curious. A young woman of Gunberg, in lower Silesia, having had a malignant disease, which occasioned the falling off of all her hair, was advised by a person, some time after her recovery, to wash her head all over with a decoction of box-wood : which she readily did, without the addition of any other drug. Hair of a chestnut colour grew on her head, as she was told it would do ; but having used no precaution to secure her neck and face from the lotion, they became covered with red hair to such a degree, that she seemed little different from an ape or a monkey.

Neither the wood nor the leaves of the box tree, at present, are used for any other medicinal purpose than the distillation of an empi-reumatic oil :—but an oil of nearly the same quality is obtained from almost every other wood.

INDIAN WOOD.—This tree grows plentifully in Jamaica, Campeche, &c. The heart of the tree, which alone is used, is at first red ; after it has been felled sometime it becomes black. It is very heavy, and in burning gives a clear, lasting flame. It is used in dyeing. It is called also *Jamaica* and *Campeche wood*.

COCHINEAL has been spoken of under the head of colours.

BRASIL WOOD, or **BRAZIL WOOD** ; an American wood, of a red colour, and very heavy. It is denominated variously according to the places from which it is brought : Thus we have *Brasil of Furnam-*

bucca, Japan, Lamon. Brailetto is the same with Brasil-wood. This tree commonly grows in dry barren places, and in the middle of rocks; it is very thick and large, usually knotty and crooked: its flowers, which are of a beautiful red, exhale a very agreeable smell, which strengthen the brain.

This wood grows naturally in the warmest parts of America, from whence it is imported for the dyers, who use it much. Though the tree be naturally very thick, yet the demand has been so great, that none of the large trees are left in any of the British plantations. The largest now remaining are not above two inches in thickness, and eight or nine feet in height, according to Mr. Catesby. The branches are slender and full of small prickles. The colour produced from this wood is greatly improved by solution of tin in *aqua regia*.

It is said, that the bark of the tree is so thick, that of a trunk which was as big as a man's body, when the bark is removed, it is scarcely left equal to that of his leg. None of the kinds have any pith, except that of Japan. That of Furnambuc is esteemed the best. It is much used in turned works, and takes a good polish: But it is chiefly used in dying, serving for a red colour. It is a colour however that easily evaporates and fades.

CEDAR of Lebanon—*Larix*. The cedar of Lebanon is not found as a native in any other part of the world, so far as hath come to knowledge. This tree is of great beauty, and bears the openest exposure so well that it is a wonder it is not more cultivated in England.

They thrive best of all in a poor soil, and are of very quick growth, as appears very plainly by those fine ones in the physic gardens at Chelsea, which were planted in 1683, and not then above three feet high, and in 1762 measured near twelve feet in the girth, at two feet above ground.

Cedar wood is reputed almost immortal and incorruptible, a prerogative which it owes chiefly to its bitter taste, which the worms cannot endure. The ancients for this reason made use of cedar tables to write on. Solomon's temple and palace were both of this wood.

The cedar brought from Barbadoes and Jamaica is a spurious sort, of so porous a nature, that the wind will leak through it. Cortes is said to have erected a palace at Mexico, in which were seven thousand beams of cedar, most of them 120 feet long, and 12 feet in circumference, as we are informed by *Herrera*.

MAHOGANY is a wood well known in England, it is a kind of cedar of Barbadoes. This tree is a native of the warmest parts of America, growing plentifully in the islands of Cuba, Jamaica, and Hispaniola, and also on the Bahama Islands. The excellency of this wood for all domestic uses is generally known. The only author who has mentioned this tree is Mr. *Catesby*, in his Natural History of Carolina and the Bahama Islands, although the wood has been brought to England for many years, in great quantities. If the plants are properly managed, they will make considerable progress in England. Some are now in Chelsea garden eight or ten feet high, which are but of a few years growth from seeds.

LIGNUM VITÆ, (THUYA) or ARBOR VITÆ. *Linnaeus* enumerates four, and *Miller* two species, viz. the occidental and the oriental. The occidental grows naturally in Canada, and other northern countries, and is used according to professor *Kalm*, for many medicinal purposes.

Guaiacum is a species of *lignum vitæ*. It grows in most of the islands of the West Indies, where it becomes a very large tree. The wood is solid and ponderous, and so hard as to break the tools in felling them. They are seldom cut down for fire wood, being difficult to burn: But it is of great use to the sugar planters, for making wheels and cogs for sugar mills. It is also brought to Europe, and wrought into bows and other utensils—*Miller*. But its principal use is in medicine. The bark and wood of this tree are much of the same nature. They are used in diet drinks to purify and cleanse the blood.

CALAMBA,

CALAMBA, CALAMBAC, or CALAMBO ; a kind of wood brought from China, usually sold under the denomination of *lignum aloes*. Sir *Phil. Vernatti* makes calambac and *lignum aloes* synonymous. Others consider calambac wood to be the best sort of aloes wood, growing chiefly in Malacca and Sumatra; and much used in India for making beads and crucifixes. *Phil. Trans.* No. 43, p. 863.

CURIOUS TREES, &c.

The BREAD FRUIT TREE. Captain *Dampier* relates, that in Guam, one of the Ladrone isles, there is a certain fruit, called the *bread fruit*, growing on a tree as big as our large apple trees, with dark leaves. The fruit is round, and grows on the boughs like apples, of the bigness of a good penny loaf; when ripe, it turns yellow, soft, and sweet; but the natives take it green, and bake it in an oven till the rind is black. This they scrape off, and eat the inside, which is soft and white, like the inside of new baked bread, having neither seed nor stone; but if it is kept above twenty-four hours, it is harsh. As this fruit is in season eight months in the year, the natives feed upon no other sort of bread during that time.

Rumphius, after describing the tree, observes, that the fruit is shaped like an heart, and increases to the size of a child's head. Its surface or rind is thick, green, and covered every where with warts. The more flat and smooth these warts are, the fewer seeds are contained in the fruit, and the greater is the quantity of pith. The internal part of the rind or peel, consists of a fleshy substance, full of twisted fibres, which have the appearance of fine wool. The fleshy part of this fruit becomes softer towards the middle, where there is a small cavity. The inhabitants of Amboyna dress it in the liquor of cocoa-nuts; but they prefer it roasted on coals, till the outward part or peel is burnt. Some people dry the internal soft part, and keep it to use instead of bread, with other food.

It

It affords a great deal of nourishment, and is very satisfying, therefore proper for hard working people. This tree is to be found on the eastern parts of Sumatra; and about the town of Bantam in Java, and is known there by the name of *socum*.

A *third* account of this fruit, we take from *Anson's Voyage*, where it says that the *rima*, or bread fruit tree, is common in all the Ladrone islands, and some of the Philippines. It is somewhat larger than our apple tree, and bears a broad leaf. The fruit hangs on boughs like apples, and is of the size of a penny loaf, with a thick tough rind, and when ripe, turns yellow. The natives gather it before it is quite ripe, and bake it till the crust is pretty black, then they rasp it; and there remains a pretty loaf, and the crumb is as soft and sweet as a new baked roll. This fruit the inhabitants enjoy about seven months, during which they never eat any other kind of bread.

Captain Cook, in his voyage, after giving nearly the same account, observes, that to procure this food, it costs the inhabitants no trouble, except climbing up a tree: The tree, indeed, grows not spontaneously; but if a man plant ten of them in his life time, which he may do in about an hour, he will as completely fulfil his duty to his own and future generations, as the natives of our climate can do by ploughing in the cold of winter, and reaping in the summer's heat; even if after he has procured bread for his household, he should convert a surplus into money, and lay it up for his children.

SAGO, or LANDAN TREE, is of considerable use in diet, as a nourisher and restorative. It is a sort of bread. The tree grows in the Moluccos, in the East Indies. When the tree is felled they cleave it in two, and dig out the pith, which is even eatable when it comes fresh out of the tree. They pound it small in a mortar; and when it is reduced to a kind of powder, somewhat like meal, they carefully separate the pure part from any remains of the wood wherewith the pith abounds. The flower thus prepared they call *sagu*: they make it into paste, and bake it in earthen furnaces; and this they do with so much expedition, that one man may

may make as much bread as will feed an hundred persons a day.

From the same tree they draw a liquor, as agreeable to drink as our wines.

The leaves, when they are young, are covered with a kind of cotton, whereof they make cloth; and as they grow older they serve them to cover their houses, instead of tiles. The larger of these leaves serve for flakes in building; and of the smaller, they produce a kind of hemp, wherewith they make very good ropes.

CORK-TREE. The cork which is used by us is the bark. The fruit of the cork-tree is a real acorn, which feeds much more than that of the oak. It is found in great abundance in Spain, Italy, France, &c. To take off the bark, they make an incision from the top to the bottom of the tree, and at each extremity another round the trees, perpendicular to the first. When stripped from the tree, which does not therefore die, the bark is piled up in a pond or ditch, and loaden with heavy stones to flatten it, and reduce it into tables; hence it is taken to be dried; and when sufficiently dry, put in bales for carriage. If care be not taken to strip the bark, it splits and peels off of itself; being pushed up by another bark from underneath. The bark and the acorn of the cork-tree are of some use in medicine, being both reputed as astringents, after being burnt and powdered, when used externally: But the chief employment of the former is to stop bottles, and sometimes to put in shoes and slippers. And the Spaniards burn it to make that light kind of black, called *Spanish black*, used by painters.

TALLOW-TREE is a tree growing in China, in great plenty. It produces a substance like our tallow, and serves the same purpose.

It is about the height of a cherry-tree, its leaves in form of a heart, a deep shining red colour, and its bark very smooth. Its fruit is inclosed in a kind of pod, or cover like a chesnut, and consists of three round white grains, of the size and form of a small nut, and within each a little stone. This stone is encompassed with a white pulp, which has all the properties of true tallow,

both

both as to consistence, colour, and even smell; and accordingly the Chinese make their candles of it, which would doubtless be as good as those in Europe, if they knew how to purify their vegetable tallow, as well as we do our animal tallow. All the preparation they give it, is to mix a little oil with it, to make it softer and more pliant. it is true, the candles they make yield a thicker smoke, and a dimmer light than ours; but those defects are owing in a great measure to the wicks, which are not of cotton but only a little rod or switch of dry, light wood, covered with the pith of a rush, wound round it; which being very porous, serves to filtrate the minute parts of the tallow, attracted by the burning flick, which by this means is kept alive.

The **LIQUORICE-SHRUB** is cultivated in many parts of England, particularly in Yorkshire; in some provinces of France, Spain, Germany and Muscovy; and especially in Persia, where it thrives better than any where else, there being some whose roots are bigger than the arm; and whose juice, in respect of strength, virtue, &c. are preferable to others.

The root of the liquorice plant runs or spreads a great way in the ground, and emerging into air from place to place, produces so many new stems or plants, few of which rise above five feet high. Its leaves are thick, green, shining, &c. its flowers red, like the hyacinth, and its seed is contained in roundish pods.

It requires a light, rich soil. It is planted in trenches three spits deep, in rows at a foot distant.

New green liquorice should be smooth, and even, about the thickness of the middle finger, ruddy without, yellowish within, easy to cut, and of an agreeable smell.

This root being boiled a long time, in water, till the fluid has got a deep yellow tincture, and the water afterwards evaporated over a moderate fire; there remains a black solid sediment, which we call liquorice, or liquorice juice, or Spanish juice.

In choosing liquorice, that which is black without, and of a shining black within, easy to break and of an agreeable taste is the best. The whitish and yellowish liquorice

liquorice juices are of little worth, being sometimes only a composition of sugar, starch, a little gum tragacanth, and liquorice powder.

The native liquorice juice is very sweet upon the palate, even more than sugar or honey; it is accounted a great quencher of thirst, on which account *Galen* prescribes it in dropsies. It is very balsamic, and there are few medicinal compositions for diseases of the breast, but it is an ingredient in. It is of considerable use against coughs, and other diseases of the breast and lungs.

FOSSIL, or *Subterraneous Wood*, is found in divers places under ground; whether overturned and buried there from the time of the deluge, as many suppose; or whether formed and produced there, as jet is known to be, is not quite clear.

Not long ago there were found in England, at above an hundred feet depth, several huge oaks, with all their branches on, and which by their situation had contracted a black colour, nothing inferior to jet; joined with a hardness, which far surpassed that of any living oak. It is hard to conceive how such trees should have come there, unless by a general subversion of the terrestrial globe at the flood. Mr. *Boyle* mentions a huge oak dug out of a salt mine in Transilvania, so hard as not easily to be wrought upon by iron tools: yet being exposed to the air out of the mine, because so rotten, that in four days it crumbled between the fingers. And Mr. *Denham* observes the same of the trees lately turned up by the breaches at Dagenham. *Phil. Transf.*

JET.—Under this general head, we will notice jet which is a light, smooth, fossil, extremely black; formed of a bituminous juice in the earth.

Jet works like amber, and has most of its qualities. It abounds in Dauphiné, but the best in the world is said to be produced in some of the northern parts of England. It readily catches fire, flashes, and yields a bituminous smell.

There is also a factitious jet, made of glass, in imitation of the mineral jet: This is drawn out into long hollow

hollow threads, which are afterwards fashioned at pleasure.

CORAL is termed a marine *plant*. That learned naturalist *Kercher* supposes that there are entire *forests* of it at the bottom of the sea; and M. *Tournefort* maintains that it evidently multiplies by seed, though neither its flowers nor seed be known. However, the Count de *Marsigli* has discovered some parts therein, which seem to serve the purpose of seeds and flowers. The roots of the coral are covered with a bark, beset with starry pores. The woody part of the plant is divided into branches.

The ancients believed that coral was soft while it continued at the bottom of the water, and that it became hard and solid by the impression of the air. But the moderns are convinced of the contrary by experience. There are three kinds, red, white, and black. The *white* is the rarest and most esteemed. The red is ordinarily used in medicine. It must be chosen thick, smooth and shining, and of a beautiful red. The chief use of coral, which we know of, is in chaplets, beads, and other toys.

The *places* for *fishing coral*, are the Persian Gulf, Red Sea, coasts of Africa, the isles of Corsica and Majorca, and some parts of the Spanish coast. The *time* for fishing, is from April to July. The *method* used under the direction of the company, at *Marseilles*, in France, is as follows. Seven or eight men go in a boat, commanded by the patron or proprietor; the caller throws his net, or machine, and the other six manage the boat. The net is composed of two beams tied across, with a leaden weight to press them down: to the beams is fastened a great quantity of hemp loosely twisted round, among which they mix some strong nets. In this condition the machine is let down into the sea, and when the coral is strongly embarrassed in the hemp and the nets, they draw it out by a rope: It sometimes requires half a dozen boats to draw it up, and if the rope happen to break, the fishermen are in danger of drowning.

Artificial coral is made of cinnabar well beaten, a layer whereof is applied on a piece of wood, moistened with size, dried and polished, and lastly, rubbed over with the white of an egg.

SPONGE, or *spunge*, is a kind of sea fungus, or mushroom ; found adhering to rocks, shells, &c. on the sea shore. It is distinguished into *coarse* and *fine*. Naturalists have been embarrassed, in all ages, whether to range sponge in the animal, mineral, or vegetable family. The greatest part of our sponges are brought from the Mediterranean, especially from *Micaria*, an island, near the coast of Asia.

The diving or fishing for sponge is there reckoned the top qualification for youth. The fine or small sponges are most esteemed ; and usually come to us from Constantinople. Their goodness consists in their being white, light, and the holes small and close ; the larger and coarser come from the coasts of Barbary, particularly Tunis and Algier.

Sponge taken inwardly choaks and certainly kills, by swelling, and preventing the passage of the food into the intestines. By analysis, sponge yields a deal of volatile, sharp salts, like other sea plants.

TIMBER TREES.

OAK.—The uses to which Oak is applied are numerous. It will endure all weathers and seasons ; hence it is used for purposes that are liable to such exposures, as posts, rails, boards, pales, wheel-spokes, hoops, buildings, &c. For water works it is second to none, or where exposed to both wind and water, as ship-building, &c. The bark and saw-dust are useful to the tanner and dyer ; and in washing, the ashes or lees are chosen.

ELM is of use in water works for pipes, pumps and ship planks. It makes good chopping-blocks, not being liable to break and fly in chips. It is used for axletrees by wheel-wrights. Carvers use it for foliage and curious works.

ASH

ASH is of almost universal use, particularly where it may lie dry, though often when exposed. It serves the builder, carpenter, cooper, turner, wheel-wright, &c. and at sea it is used for oars, and hand spikes.

BEECH is used among turners, joiners, and upholsterers. If for uses under water, it is said to outlast the oak. Of the bark, floats are made for fishing nets, instead of cork. It also serves for a variety of domestic uses, and was in great estimation among the ancients. The leaves of the beech continue long sweet, and make good mattresses. An oil may be extracted from the bark. The wood is of a clean fine grain, and will split so thin that it makes band-boxes, hat-cases, and even book-covers and scabbards for swords.

WALNUT is of universal use in France. It is not so proper for the outside of buildings, but there is no wood better for the joiners. It is less subject to the worms than beech and is of a more curious brown. The hickery Nut, or white virginia walnut, is very common in various parts of North America.

CHESNUT-TREE is very lasting, and is much sought after by carpenters and joiners. It is esteemed next after the Oak, but while it appears fair without, it will decay inwardly. Great part of London was anciently built with chesnut.

POPLAR, Abele, and Aspen, differ little from each other. The timber is excellent for all sorts of white wooden vessels. It is tougher and harder than fir, and is frequently used instead of it. It has something of the nature of cork and is used by some countrymen as soles for shoes.

ALDER is used for water-pipes and sluices : anciently boats were made with it, and large vessels. It is useful for trays, trenchers and wooden reels. The dyers make the bark useful. Alder endures water, and if always wet it becomes hard like a stone ; though if it be wet and dry alternately it rots presently.

BIRCH-TREE.—There are four species of birch. The common birch-tree may be cultivated upon barren land, where better trees will not thrive ; for there is no ground so bad, but this tree will thrive in it. It will grow in moist springy land, or in dry gravel or sand, where there is little surface. So that upon ground that produced nothing but moss, these trees have succeeded so well, as to be fit to cut in ten years after planting, when they have been sold for near ten pounds per acre, standing, and the after-produce has been considerably increased. Many woods near London, which were chiefly stocked with these trees, having been of late years grubbed up, the value of these plantations has advanced in proportion. Persons, therefore, who are possessed of poor land, cannot employ it better, than by planting it with these trees, especially as the expence of doing it is not great.

Broom-makers are constant customers for birch. Hoop-benders are also great purchasers. The largest trees are often bought by the turners ; and the wood is used for making ox-yokes, and other instruments of husbandry. In some of the northern parts of Europe, the wood of this tree is greatly used for making wheels for carriages, being hard and of long duration.

In France, it is generally used for making wooden shoes, and it is good fuel. In some places, these trees are tapped in the spring, and the sap drawn to make birch wine, which has been recommended for the stone and gravel. Mr. *Boyle* tells us, he has seen extraordinary medicinal effects of the juice itself. He says the juice may be easily preserved, by pouring a little oil on the top of it, or by distillation, &c.

The piercing and bleeding of birch is performed thus: about the beginning of March, cut a slit almost as deep as the pith, under some well-spreading branch ; cut it oblique, and not long-ways, and insert a small stone, or chip, to keep the lips of the wound a little open ; lastly, to this orifice fasten a bottle, into which will distil a limpid and clear water, retaining an obscure smack both of the taste and odour of the tree. The wonder is, that in the space of twelve or fourteen days, as much juice

juice will be gathered, as will outweigh the whole tree, body and roots. *Phil. Transf.*

LARCH-TREE.—*Linnaeus* refers this to the genus of *pine*. The common larch-tree grows naturally upon the Alps and Appenines, and has lately been much propagated in England. One kind of this tree is a native of America. In many places ships are built of this wood, which are said to be durable; and, therefore, this may be a very proper tree for planting upon the cold barren hills of England; which, beside the profit they would yield to their proprietors, would also conduce to national benefit. The *venice turpentine* is extracted from the larch-tree.

PINE.—From the wild pine is procured the common turpentine. The leaves and tender tops of pine and fur are used for diet-drinks. Pitch, tar, rosin, and turpentine are all made from those trees, by a very familiar process. In the spring time, when the sap is most free in running, they pare off the bark of the pine-tree, to make the sap run down into a hole which they cut at the bottom to receive it; in the way as it runs down, it leaves a white matter like cream, but a little thicker: This is very different from all the kinds of resin and turpentine in use, and it is generally sold to be used in the making of flambeaux, instead of bees' wax. The matter in the hole at the bottom, is taken up with ladles, and put into a large basket; a great part of this immediately runs through, and this is the common turpentine. From the thicker matter that remains in the basket, is produced the oil, or spirit of turpentine; the remaining matter at the bottom of the *still*, is common yellow resin. When they have obtained all they can from the sap of the tree, they cut it down, and hewing the wood into billets, and setting them on fire, there runs from them, while they are burning, a black thick matter: this falls to the bottom of the pit, and this is the *tar*. The tar being thus made is put into barrels, and if it be to be made into *pitch*, they put it into large-boiling vessels, without adding any thing to it. It is then suffered to boil

awhile, and when cold, is what we call pitch. *Phil Transf.* No. 243, p. 291.

FIR.—*Linnaeus* makes the *fir-tree* only a different species of the pine and the larch. There are nine species of *fir* in the English gardens. The silver fir-tree, and the pitch tree, or the Norway and *spruce fir*. The first grows about Strasburg and other parts of Germany, from whence the turpentine is brought to England. The second sort is common to the woods of Norway, and affords the *white deals*. From the *spruce firs* is made the *spruce beer*.

A very good method of seasoning planks of *deal* and *fir*, is to throw them into salt water as soon as sawed, and keep them there for three or four days. This renders them much harder, if dried afterwards in the air and sun.

OSIR or WILLOW.—Of the willow there are many species; *Linnaeus* enumerates thirty. The weeping willow grows naturally in the Levant, and has been for many years cultivated in the English gardens. The *common fallow* requires a drier soil than the other species, and will thrive upon the highest hills, whence it is called mountain *osir*. The wood of this is converted into *charcoal*, for making gunpowder and drawing pencils. The Laplanders make a sort of leather of the bark, which they manufacture into gloves. The *common willow* loves a moist and open situation, and grows quick. The Rev. Mr. *Stone* has lately found the bark of this tree an useful medicine in agues. It must be gathered in summer, when full of sap. Our common willows in the spring season, when they are in flower, produce a quantity of cottony matter. The Chinese are industrious enough to collect this cotton as it falls from their willows; and the women and children, among the poorer people, card it, &c. and render it fit for many uses.

The *wood* of the willow, though in itself very light and spongy, is yet of a nature to bear the injuries of wet, better than almost any other kind. It is used by the Chinese on all occasions, where the wood is to stand under water, and succeeds well.

Salix

Salix is also a species of the willow or osir.

Mr. Ray, and other authors, speak of trees of prodigious bulk. The Jesuit *d'Acosta* in his history of the Indies, mentions a hollow tree in new Spain, nine fathoms within side, near the ground, and sixteen without side. He adds, that it is under this tree the barbarians assemble to perform their religious ceremonies, dance round their idols, &c. *Herrera* mentions another, which sixteen men joining hands cannot fathom. *F. Kircher* affirms, he has seen a tree, near Gonzano, which would lodge a whole family of twenty-five persons in its cavity. The common people have a tradition that it was planted by *Augustus*.

In the Indies there are very large forests, consisting only of a single tree, whose branches, falling to the ground, take root, and put forth new trees: the fig-tree and paretwirer are of this kind.

In Peru, there are trees according to *M. Lonvillers*, one part of whose branches produce fruit one half of the year, and the other part the other half.



 PART SECOND.

PRODUCTIONS

FOR

FOOD, and OTHER USES.

TEA, *Thea*, or as the Japanese call it, *Tcha*; the leaf of a tree or shrub, growing in several provinces of China, Japan, and Siam; whose infusion is in general use as a drink. The tree-plant likes vallies, and the feet of mountains, and a stony soil. Its seed is usually sown in places exposed to the south; and bears three years after sown. The root resembles that of the peach tree; the leaves are green, longish at the point, and pretty narrow, an inch and a half long, and jagged all around. The flower is much like that of the wild rose. The fruit is of different forms, sometimes round, sometimes *long*, sometimes triangular; of the ordinary size of a bean; containing two or three peas, including each a kernel. These peas are the seeds by which the plant is propagated.

The tree is of various heights, from one foot to an hundred; some there are which two men cannot fathom, while others scarcely exceed the feeblest shrub in a garden. The best time to gather the leaves of tea, is while they are yet small, young, and juicy; when gathered, they are passed over the smoke of boiling water to moisten them; then they are laid on copper plates which are heated; and, thus the leaves drying, they curl up in the manner they are brought to us. It is very rare to find tea perfectly pure; the Chinese always mixing other herbs with it to increase the quantity. Though among them it is sold moderate enough; from three-pence to nine-pence per pound.

It

It is said the Chinese know nothing of the many names which serve to distinguish the teas in Europe, as flower of tea, imperial tea, &c. Yet they have a distinction of their own, as *Voui* and *Soumlo*, which are reserved for people of the first quality and for sick persons.

The *green tea* is the common tea of the Chinese. *F. le Compte* calls it *bing tea*, and says it is gathered from the plant in April; and that the *voui tea*, *bou tea*, or *bohea tea*, is gathered a month before it, viz. in March, while in the bud; and hence the smallness of the leaves, as well as the depth of the tincture it gives water. Others, however, take it for the tea of some particular province, the soil being found to make an alteration in the properties of the tea, as much as the season of gathering it.

The drink tea, is made in China, and throughout the greatest part of the east, after the same manner as in Europe—viz. by infusing the leaves in boiling water, and drinking the infusion hot. Indeed, with us, it is usual to temper its bitterness with sugar, which the orientals use little or none of.

The Japanese, however, are said to prepare their liquor a somewhat different way, viz. by pulverizing it, stirring the powder in hot water, and drinking it as we do coffee.

The Chinese are always taking tea, especially at meals. It is the chief treat wherewith they regale their friends. The most moderate take it at least thrice a day; others ten times or more; and yet it is computed that the consumption of tea among the English and Dutch is as great in proportion, as among the orientals. In France, the use of tea has for many years declined, and coffee, afterwards became the most prevailing liquor.

Much has been said and written about the *properties* of tea. The reason why the gout and stone are unknown in China, is ascribed to the use of this plant; which is further said to cure indigestions of the stomach, to dispel wind, to cure the vapours, &c. *Sim. Pauli*, physician to the king of Denmark, in an express treatise on this plant, endeavours to show that the virtues ascribed to it in the east are local, and do not hold with the inhabitants of Europe. According to him those past their fortieth
year

year should never use it, as being too disiccative, or apt to dry up the humors and moisture of the body. He adds that tea has no other virtues but those of betony ; and observes, with *Bauchin*, that it is only a species of myrtle, found in Europe, as well as the Indies. *Peehlin* refutes this opinion, and maintains that it is good to prevent scorbutic diseases; that its gentle astringent virtues strengthen the tonic motion of the intestines, &c.

COFFEE is a *seed*, or *berry*, brought from Arabia Felix, used for the making a drink of the same nature. By coffee we usually mean the drink itself, prepared from those berries. Its *origin* is not well known: some ascribe it to the Prior of a monastery, who being informed by a Goat-herd, that his cattle sometimes browsing on this tree, would wake and caper all night; became desirous to prove its virtue; accordingly he first tried it on his monks, to prevent their sleeping at matins. Others refer the invention of coffee to the Persians, from whom it was learned in the fifteenth century by a *Musti* of Aden, a city near the mouth of the red sea; and who having tried its virtues himself and found that it dissipated the fumes which oppress the head, inspired joy, opened the bowels, and prevented sleep, without being incommoded by it; recommended it first to his dervises, with whom he used to spend the night in prayer.

Their example brought coffee into vogue at Aden: the professors of the law, for study, artisans to work, travellers to walk in the night; in short, almost every body at Aden drank coffee. Hence it passed to Mecca, and from Arabia Felix to Cairo, and from Egypt to Syria and Constantinople.

Thevenot, the traveller, was the first who brought it into France: and a Greek servant, called *Pasqua*, brought it into England in 1652, and setting up the profession of *coffee-man*, first introduced the drink among us. Though some say *Dr. Harvey* had used it before.

The word coffee is originally Arabic: the Turks pronounce it *Cahuch*, and the Arabs *Cahuah*.

The Mahometans make coffee from the *pods* as well as the berries, some Europeans have called that made
of

of the pods, *the Flower of the coffee tree*. But these being found improper for transportation, the berry is what is used in Europe.

The preparation of coffee consists in roasting it on a setalline or earthen plate, till it have acquired a brownish hue. As much is then ground in a mill, as serves the present occasion. The manner of boiling it for use, needs no description.

The Turks do not trouble themselves to take off the bitterness by any sugar, according to our custom. But their grandees add to each dish a drop of essence of amber; others boil it with a couple of cloves, &c. Coffee is one of the necessaries with which the Turks are obliged to furnish their wives.

The ordinary method of roasting coffee with us, is in a tin cylindrical box, full of holes; through the middle of which runs a spit; under this is a semi-circular hearth, wherein is a large charcoal fire: by the help of a jack the spit turns swift, and so roasts the berry; being now and then taken up to be shaken. When the oil rises, and it is grown of a dark brown colour, it is emptied into two receivers, made with large hoops, whose bottoms are iron plates. There the coffee is shaken, and left till almost cold; and if it look bright and oily, it is a sign it is well done. The oily matter, and its particular smell, distinguishes it from peas, beans and rye, &c. which some substitute in lieu of coffee.

Some take coffee to prevent sleep, others to promote digestion. Its more real virtues, owned by the Physicians, consists in this; that being an excellent drier, it carries off fumes and disorders of the head, arising from too much moisture; absorbs acrimonies of the stomach; promotes watching, by bracing the fibres, and rendering them too tense, for the relaxation required in sleep. It likewise promotes circulation, but best with people of a pretty corpulent habit; being found hurtful to those who are thin, lean, dry, and of a bilious temperament, as it dries up the nerves and inclines them to tremors.

The tree that produces the coffee is a kind of Arabic jessamin; the berry when ripe is found as hard as horn, which gave occasion to an opinion that the people who cultivated

cultivated it in Arabia Felix steeped in boiling water, or baked in a furnace, all the coffee they sold abroad, to prevent its growing any where else.

CHOCOLATE, a kind of cake, or confection, prepared of certain drugs; the basis or principal whereof is the *cocoa nut*. The *drink* prepared from this cake is also called chocolate, and is usually drank hot, being esteemed not only an excellent nourishing food, but also a good medicine; or at least a diet for keeping up the warmth of the stomach, and assisting digestion.

The Spaniards were the first who brought chocolate into use in Europe; and that perhaps as much out of interest, as out of regard to its virtues. For by this means they obtained a better market for cocoa nuts, achiott, vanilla, and other drugs, which their West Indies furnish, and which enter into the composition of chocolate.

The *method of making* first used by the Spaniards, was very simple, and the same with that in use among the Indians: they only used cocoa nut, maize, and raw sugar, as expressed from the canes, with a little achiott, or rocou, to give it a colour. Of these four drugs ground between two stones, and mixed together in a certain proportion, those Barbarians made a kind of bread, which served them equally for solid food and for drink; eating it dry when hungry, and sleeping it in hot water when athirst.

But the Spaniards and other nations have since added a great number of other ingredients, to the composition of chocolate.

Among the Spaniards of Mexico, the *present* method of making it is as follows. The fruit being gathered from the cocoa-tree is dried in the sun, and the kernel taken out and roasted at the fire, in an iron pan, pierced full of holes; then pounded in a mortar; and ground on a marble stone, till it be brought into the consistence of a paste; mixing with it more or less sugar. In proportion as the paste advances, they add some long pepper, a little achiott, and lastly, vanilla: some add cinnamon, cloves, and anise: and those who love perfumes, musk and ambergris.

The

The chocolate made in Spain is somewhat different; for, besides the drugs used in the above, they add two or three kind of flowers, almonds, hazle nuts, &c. They frequently work their paste with orange water, which they think, gives it a great consistence and firmness.

The paste is usually made up into cakes, sometimes into large rolls. The newest chocolate is esteemed the best; the drug never keeping well above two years: and usually degenerating much before that time.

The best chocolate is that which dissolves entirely in the water, leaving no ground or settlement at the bottom of the pot.

The Spaniards think it the last misfortune that can befall a man, to be reduced to want chocolate; they are never known to leave it, excepting, for some other liquor that will intoxicate.

SUGAR; a sweet juice expressed from a kind of canes, or reeds, growing in the East and West Indies. Whether the ancients were acquainted with this cane, and whether they knew how to express the juice from the same is uncertain. If they did know the cane and the juice, they knew not the art of condensing, hardening, and whitening it, and of consequence knew nothing of our sugar.

Salmassius assures us, that the Arabs have used the art of making sugar, such as we now have it, above eight hundred years. *F. Labat*, a Dominican missionary, proves that the sugar cane is as natural to America as India, but the Spaniards first learnt from the orientals, the art of reducing it into sugar.

The reed or cane resembles those which we see in morasses, and on the edges of lakes; excepting that the skin of these latter is hard and dry, and their pulp void of juice; whereas the skin of the sugar reed is soft, and the spongy matter or pith it contains very juicy. The circumstances which contribute to its goodness are, goodness of soil, exposure to the sun, being cut in a proper season, and its due age.

The cane usually grows five or six feet high, and about half an inch in diameter; though *F. Labat* mentions some extraordinary ones in the Isle of Tobago,

twenty-four feet high. The stem or stalk is divided by knots, a foot and half apart. At the top it puts forth a number of long, green tufted leaves, from the middle, whereof, arise the flower and the seed.

The ground fit for sugar canes should be well exposed to the sun. The canes are usually planted in pieces, cut a foot and half below the top of the flower. They are ordinatily ripe in ten months though sometimes not till fifteen, at which time they are found quite full of a white succulent marrow, whence is expressed the liquor whereof sugar is made. When ripe and cut they are carried in bundles to the mills. The mills consist of three wooden rollers, covered with steel plates, and have their motion either from the water, the wind, cattle, or even the hands of slaves. Those turned by the hand, are now laid aside; they were an intolerable hardship on the poor negroes: Wind-mills are the most common. When the canes are pressed and broken between the rollers, the juice runs through a little canal into the sugar house, which is near the mill, and is thence conveyed into its first copper or cauldron, to receive its first preparation, and only heated by a *slow fire* to make it simmer. A quantity of ashes and quick lime is here mixed with the liquor, and the effect of which mixture is that the *unctuous parts are separated* from the rest, and by the heat, are raised to the top in form of a thick scum. These unctuous parts being kept constantly scummed off, serve to feed the poultry.

The juice is then farther purified in a second copper, where a brisker fire makes it boil, the casting up of the scum is still promoted by means of a strong lye composed of lime-water, &c. It is then purified and scummed in a third boiler, and afterwards in a fourth and a fifth where it is brought to the consistence of a syrup. In a sixth boiler, the syrup receives its full concoction, and here all the impurities left from the former lyes are taken away by a new lye. In this last copper, there is scarcely one third of what was in the first; the rest being wasted in scum.

In some larger sugar works, there are also particular coppers, for the boiling and preparing the *scums*.

When the sugar is taken out of the sixth copper, it is put

put into a cooler ; where, stirring it briskly together, it is let stand to settle, here it remains till it be fit to barrel. This is termed crude sugar.

Earthed sugar is that which is *whitened* by means of *earth* laid on the top of the forms it is put in. In making this kind they use the best canes, and work with more care and nicety, and strain it through a blanket from the first to the second copper, &c. From the sixth cooler it is taken out into *conical moulds*. After standing a sufficient time, *earths* are laid on the surface of the sugar. The earth is applied in the consistence of a *pulp*; and when it has remained thereon for many days, and is become quite dry, it is carefully taken off, and a second layer of earth applied; these earths imbibing only certain parts of the sugar, contribute to whiten it. The second layer of earth being removed, as the first, the sugar loaves are taken from the moulds or forms, and dried in a stove. Eight or ten days and nights of continued violent fire, usually is sufficient to dry a stove of sugar.

Refined Sugar.—The heads and tops of loaves that have not whitened well, also strained sugar and crude sugar, are the basis or ground of this sugar.

For *refining*, a quantity of lime water and sugar are put into a copper; as the scum is raised by the heat, it is taken off, till it cease to rise, and then the syrup is strained through a cloth. After this it is *clarified*: that is, a dozen of eggs is thrown, white, yoke, shell and all, being first beaten up well in lime water. This gathers the impurities of the sugar to the *surface*, whence it is skimmed off. This is repeated till it be sufficiently clarified. The drying, &c. is performed similar to the *earthed sugar*, but with greater exactness.

The basis of *royal sugar* is the finest refined sugar. This is melted with weak lime-water, and sometimes allum water is used. By clarifying it three times, passing it as often through a close cloth and using the very best earth, it becomes so transparent, that we see a finger touching it, even through the thickest part of the loaf.

Sugar Candy is sugar crystallized. For this, *earthed* sugar is better than *refined*, because sweeter. To candy

it, it must be first dissolved, clarified, scummed, strained, boiled, &c. It is then put in forms or moulds, that are traversed with little rods, to retain the sugar as it crystallizes. These forms are suspended in a hot stove, with a pot underneath, to receive the syrup that drops out at the hole in the bottom. Upon this the sugar falls to the sticks that cross the forms, and there hangs in little splinters of crystal. To make *red* sugar candy, they cast into the vessel, where the sugar is boiling, a little juice of the Indian fig. If perfumed, a drop of some essence. This is the method practised by *F. Labat*, in the Caribbees; the method in Europe described by *Pomet* is somewhat different. *White* sugar candy is made of white refined sugar.

BARLEY-SUGAR; so called, because the sugar was formerly boiled with barley, but now water is generally used to make the sugar the finer. It is first boiled till it be brittle, and then cast on a stone anointed with oil of sweet almonds, and formed into twisted sticks in the form and size which we see. To give it the bright amber colour, saffron is added sometimes. Barley-sugar is found very good for the cure of colds and rheum.

MOLOSSES; that gross matter, remaining of sugar after refining, and which no boiling will bring to a consistence more solid than that of syrup; hence, also, called syrup of sugar. Molosses are properly only the sediment of one kind of sugar, which is the brown or refuse of other sugars, not to be whitened, or reduced into loaves. There is a kind of spirit made of molosses.

RICE, *criza*, a grain, or seed. It is frequent in Greece, Italy, and the East Indies. The grains of rice, which grow in clusters, are severally inclosed in yellow, rough cases. Rice grows in marshy places. It is a great food in the Roman Catholic countries in time of Lent; and throughout the East, and a great part of the Levant, rice is the principal food, and serves for bread. In the Indies, the women thresh and dress all the rice, which is a very painful office, that the men leave to them, either out of idleness or disrespect.

The

The Chinese make a wine of rice, which is of an amber colour, tastes like Spanish wine, and serves them for their common drink. A very strong brandy or spirit is also drawn from rice, in some parts of Europe.

Rice is of use in medicine, being proper to soften and thicken sharp humours, to moderate fluxes of the belly, &c. The northern nations eat their fowls and other meat with rice and saffron. Rice is of a shining white colour, and as it were transparent.

SALT, in its usual sense, denotes a kind of saline crystallization; or a sharp pungent substance, used to season and give a relish to various kinds of foods. This is called *common salt*, in contra-distinction to the chymical salt. There are three kinds of common salt, viz. sea-salt, fossile or rock-salt, and salt drawn from briny springs. For *sea-salt*, the best is made in France, but little in England. *Fossile or rock-salts* are chiefly found in Poland, Hungary, and Catalonia. For salt springs, they are considerable in Cheshire, Worcestershire, Hampshire, Northumberland, and various other places.

The great property of salt is, that it is incapable of corruption—that it preserves meats, &c.—that it endures the fire, and even comes purer out of it. In very hot fires it fuses. Salt gives fertility to lands. *Sea-salt* is made of sea water. It is thickened by frequent evaporations. Some is called *bay-salt*. This is thickened and brought to its consistence by the heat of the sun, and is of a brown colour. That which receives its consistence from the heat of a fire, is called *white salt*.

Low, marshy grounds, disposed for the reception of the sea waters, when the tide swells, are provided with banks and sluices to retain the same, and this is called a salt marsh. These are divided with care into several square pits or basons, which receive the sea water. The salt season is from the middle of May till the end of August, in which time, the sun's rays being strongest, the salt is raised and crystallized better than at any other season. The water is first warmed by means of vast reservoirs, without the works, the rest is left to the wind and sun; by whose power, the surface of the briny water first becomes covered over with a slight crust. Still

hardening, it is afterwards wholly converted into salt.

When the salt is found sufficiently dry, it is drawn out and left in little heaps about the head of the pits, where it receives its last state of hardness. Eight, ten or fifteen days having thus perfected the crystallization of the salt; the sluices are again opened for a fresh supply of salt water, which passes through the same operation. The salt is brown when taken out of the pits, and is usually thus sold without farther preparation; though in some places it is made into white salt by refining. They refine it by boiling it in large flat chaldrons, which not only takes away its acrimony, but is found to increase the quantity.

White Sea Salt, is made in Normandy not by refining the Bay Salt, for the colour is natural to it when taken out of the pits. To make it they gather a muddy sand on the flats of the shore, which the rising tide has covered and impregnated with its waters for seven or eight days. The sand being removed into pits for the purpose, discharges itself by degrees of all its water, which filtrates through some straw, wherewith the bottom of the pit is filled, and trickles into vessels set on purpose to receive it. Of this water it is that they make their Salt.

Their furnaces are of earth, and their boilers of lead. When the water in the lead begins to boil, they take off the skim, which arises in abundance, and then throw in more water and skim as before. When it thickens they keep it continually stirring, and when the grain is formed they take it off the fire to purify. The purifying is performed by letting it stand in large osier baskets; where it drains itself of certain humidities that remained. When dry it is laid in heaps, and thence carried into the magazines.

Rock-Salt was entirely unknown to the ancients.

The Polish mines near Cracow, were discovered in 1251 their depth and capacity are surprizing. Within them is found a kind of subterraneous republic, which has its polity, laws, families, &c. and even public roads, carriages and horses: being for the conveyance of the salt to the mouth of the quarry, where it is taken up by the engines. These horses when once down never see the light

light again ; but the men take frequent occasions of breathing the village air. When a traveller is arrived at the bottom of this strange abyss, where so many people are interred alive, and where so many are even born and have never stirred out, he is surprized with a long series of lofty vaults, sustained by huge pilasters, cut out with chissels and which being themselves rock salt, appear by the light of flambeaux which are incessantly burning, as so many crystals or precious stones of various colours, casting a lustre which the eye can scarcely bear.

One of the chief wonders of this place is, that through these mountains of salt, and along the middle of the mine, there runs a rivulet of fresh water sufficient to supply the inhabitants.

As soon as the massive pieces are got out of the quarry, they break them into fragments fit for the mills, where they are ground, and reduced into a coarse farina, which serves all the uses of sea salt.

There are four kinds, white, bay, red and brilliant; the last is the proper *Sal-Gemma* of the druggists, all these become white by grinding, though perhaps they appear of various colours before.

Brine-springs, are fountains which flow with salt water instead of fresh. According to *Campbell's Political Survey*, many be found in different parts of the kingdom. In Cumberland, at Barrow-deal, a pretty strong spring arises, sixteen gallons of which yield one of pure salt. At Weston in Staffordshire, there are brine pits which afford about a ninth part of very fine salt.

Near Northwich, at the confluence of the Weever and the Dan, six ounces of salt is obtained from sixteen of water. At Droitwich in Worcestershire, the salt produced from the brine springs supply all that part of the country and from the port of Bristol it is exported to other countries. At Middlewich which stands at the confluence of the rivers Croke and Dan, there are salt springs, with a fresh brook running between them.

The brine of these pits commonly obtain four ounces of salt from a pound of brine.

Our method of drawing the salt from the brine, in England is thus ; near the spring or place of the brine is built a saltern, or boiling-house. This contains several

veral huge flat pans, or boilers, each furnished with its grate and furnace. The brine being in the pan the fire is kindled, and after two hours time the liquor begins to be ready to granulate ; which is known by a thin skim rising at the top ; this they skim off into brine tubs, that the brine that goes with it may not be lost. Afterwards in order that the salt remaining may precipitate, they shut up the vent holes and door, and let the fire go out, and in twelve hours time the salt falls to the bottom and grows hard ; a liquor called the bittern remaining at top, which being again boiled away, yields more salt.

The salt left in the flat pans is now racked up to one side, taken out and put into cribs or vessels ; where it soon becomes an hard granulated salt. Some, afterwards, bake the loaves twice or thrice in an oven.

In some parts of England they use water raised by the sun, and then boiled, which they think preferable to the natural brine of springs.

CHEESE is prepared of *curdled milk*, purged from the serum or whey, and afterwards dried for use.

Cheese differs in quality according as it is made from new or skimmed milk, from the curd which separates spontaneously upon standing, or that which is more speedily produced with runnet. There is also a kind of cheese from cream, which is quite fat and butyraceous, and does not keep long. Dr. *Percival's* experiments, prove it evidently to be of a septic nature, that is causing or promoting putrefaction. And the common opinion that old cheese digests every thing, yet is undigested itself, is said to be without any solid foundation.

Cheese made from the milk of sheep digests sooner than that from the milk of cows, but is less nourishing.

As a food, physicians condemn the too free use of cheese. When new it is extremely difficult of digestion ; and when old it becomes acrid and hot.

Every country has places noted for this commodity ; thus Chester and Gloucester cheese are famous in England ; and the Parmesan is in no less repute abroad, especially in France ; this sort is made of sweet cows milk ; but at Rochfort in Languedoc, they make it of ewes milk ; and in other places it is made of goats, or ewes in a certain proportion with that of cows. Of

Of all the Cheefe this kingdom produces, none is more esteemed than the *Stilton*, which is called the *Parmesan* of England, and is never sold for less than one shilling or fourteen pence per pound. They require to be kept two years before they are properly mellowed for sale. The making of what is called *Stilton* cheese, is not confined to *Stilton* farmers. Others in *Huntingdonshire* and even in *Rutland* and *Northamptonshires*, make a similar sort, selling them for the same prices, and give all of them the name of *Stilton* cheeses.

The *double Gloucester* is a cheese that pleases almost every palate and is held in high esteem. *Cheddar-cheese* is admired ; its goodness is said to be owing to the richness of the land, rather than to any thing peculiar to the method of making, being the same as is pursued in *Somersetshire* and the adjoining countries.

Cheshire cheese is much admired by some people. A cheese is sometimes above a hundred pounds weight.

In order to give a high colour to cheese it is usual to put a little *annatto* with the milk before it is turned. No cheese will look yellow without it, and it is perfectly innocent in its nature and effects, but it does not add any thing to the goodness of the cheese.

BUTTER, is a fat, unctuous substance, prepared or separated from milk, by beating or churning it. But little description is necessary, of articles so well known. *Schookius* observes that in *Spain* butter is seldom used, except medicinally, for ulcers, and the *Dutch* introduced the use of it in the *East-Indies*. The *Romans* used butter no otherwise than as a medicine, never as a food. *Pliny* says, that among the barbarous nations it was a delicate dish. The *Greeks* had not an early knowledge of butter. Their poets though they make frequent mention of milk and cheese make not the least mention of it.

Cl. Alexandrinus observes that the ancient *Christians* of *Egypt* burnt butter in the lamps, at their altars, instead of oil ; and the *Abyssinians* according to *Godignus*, still retain a practice much like it.

Cream is that part of the milk, of which butter is made ; it is the thickest and fattest part of it.

FRUITS

FRUITS.

ORANGES make an article of considerable merchandize. Those called China-oranges were first brought into Europe from China, by the Portuguese; and it is said, that the very tree, whence all the European orange trees of this sort were produced is still preserved at Lisbon.

The China Orange is not so hardy as the Seville, and rarely produces good fruit in England, nor are the leaves of the tree near so large or beautiful as those of the Seville Orange. There are a great variety of sweet oranges both in the East and West Indies, some of which are much more esteemed than those we now have in Europe, but as they are much tenderer they will not thrive in this country with the common culture. *Miller.*

Those most esteemed, and that are made presents of, as rarities, in the Indies, are no bigger than a billiard-ball; when they are sweetened with sugar, they are esteemed excellent for disorders of the breast. The juice is cooling, and antiscorbutic.

Oranges are brought from Nice, Ciouta, Seville and other parts of Spain, from Genoa, Provence, Portugal, the American Islands, and even China and the coasts of India.

Oranges are ordinarily comfited into halves and quarters. They are first peeled, then scooped and dried in a stove. *Orangeat* is the orange-peel cut in pieces and candied.

There are various oils drawn from oranges, and are esteemed good for destroying worms in children, but they are apt to be sophiscated with oil of ben, or that of sweet almonds.

CITRON is the produce of a tree much resembling the lemon-tree. A citron has the same qualities as the lemon, but bigger, higher colour and a brisker smell. It is an agreeable fruit, and serves like that to cool and quench the thirst. It is held excellent against poisons; and *Athenæus* relates an instance of two persons preserved safe from the most dangerous aspics, by eating a citron.

Genoa

Genoa is the great European nursery for this sort of fruit. The Florentine Citron, *Miller* says, is in such great esteem, that the single fruits are sold at Florence, for two shillings each, and are sent as presents to the courts of princes. This kind is not to be had in perfection in any other parts of Italy, but in the plain between Pisa and Leghorn, and if transplanted to other parts they loose much of their excellence.

From citrons are produced essences, oils, confections, waters, &c.

• LEMON is a species of the *Citrus* or *Citron-tree*. There are some varieties of this tree. The common Lemon, the sweet, the lesser sour, and the common sweet lemon are the four sorts that are brought from Lisbon every year in great plenty. The culture of citrons, lemons and oranges merit particular attention. They are elegant evergreens, rising in this country from about five to ten feet in height, forming full and handsome heads, closely garnished with beautiful large leaves all the year round, and putting forth a profusion of sweet flowers in spring and early in summer; which even in this climate are often succeeded by abundance of fruit, that sometimes arrive at tolerable perfection.

The most cheap and expeditious method of procuring a collection of these kind of trees, is to have recourse to such as are imported from Spain, Italy and Portugal. These come over in chests, without any earth to their roots, and heads a little trimmed; they are commonly from one inch to two or three in diameter in the stem; from two to four or five feet in height; and by the assistance of a bark bed they readily take root, and grow freely; forming as good trees in two years, as could be raised here by inarching or budding in fifteen, or twenty. They are sold in the Italian warehouses in London. Their price is from three shillings to a guinea each.

The fruits of the citron, lemon and orange trees, yield very agreeable acid juices, which besides the uses to which they are commonly applied answer considerable purposes in medicine. The young fruit of the seville orange dried are used in medicine under the name of *aurantia curassaventia*.

MELON;

MELON; a species of *cucumis*. The *Cantaloupe melon*, so called from a place in the neighbourhood of Rome, where this fruit has been long cultivated, and whither it was brought from Armenia, is in the greatest esteem among the curious in every part of Europe. Dr. *Tournefort* in his travels, relates that those melons never offend the stomach, but agree with all persons: And they have the same quality here; for persons who cannot bear the least piece of a common melon on their stomachs can eat these with safety. There are various other kinds cultivated in different parts of the world, Mr. *Reynolds* has communicated to the society of Arts a method of raising melons without earth, dung or water; and for this purpose tanner's bark, sawdust, &c. are used, to promote the vegetation of those seeds.

When a melon is perfectly fine, it is full without any vacuity; this is known by knocking upon it; and when cut the flesh must be dry, no water running out, only a little dew, which is to be of a fine red colour. Large melons are not to be coveted, but firm and well flavoured ones. Our gardeners who raise melons for sale, sow the seeds of the *larger*, rather than *good* kinds, and they increase the size of these by much watering the roots, but this spoils the taste. Some of the French, raise particularly fine melons, by a method pretended as a secret, but which is found to be the same with that of Mr. *Quintiny's* of that nation, published near eighty years ago. See Phil. Transf.

ALMOND, is a fruit inclosed in a thick stone, and under a thin skin. The tree that produces the almond is pretty tall, and resembles a peach tree. It is frequent in Germany, France, Spain, and the neighbouring countries, and also in Barbary. The flowers of this tree are ranged in the rose manner: the pistil becomes a fleshy fruit, containing a *seed* which is the almond, and which drops out when the fruit is arrived at maturity. There are two kinds sweet and bitter.

The bitter almonds are aperient and diuretic and on that account used in obstructions of the liver, spleen, &c. Some affirm that the bitter almonds bruised, kill or stupefy

pify fowl, so that they may be taken with the hands; which they say is a secret practice among the Bohemians.

Sweet almonds are of a soft, grateful taste; and are reputed cooling, healing and nutritive; and have a good effect in disorders from cholerick and acrimonious humours.

The oil of sweet almonds is a safe and useful remedy in pains arising from the stone: and is good for collicness and gripes in children.

TAMARINDS are brought from the East and West-Indies. Some call them Indian-dates, others Indian-acacia. The tree which yields this fruit is called by the Indians *tamarinds* and by the Portuguese *tamarindos*. It is not unlike our *ash*; its leaves resemble those of female *fern*; its flowers are joined eight or ten together, like those of the orange tree. Its fruit is in a pod, the length of a finger, and the thickness of the thumb, covered at first with a green rind, which afterwards becomes brown, and contains a blackish acid pulp, among which are found seeds resembling lupines. It is the *pulp alone* that is brought to us, and used in medicine. Tamarinds must be chosen big, of a jet colour, a brisk taste, not too dry, and such as have not been falsified with molosses of sugar and vinegar.

They are found laxative, cooling, and good to quench thirst.

These trees grow to a great magnitude in their native countries; but in Europe they are preserved as curiosities by those who are lovers of rare plants.

PRUNES; are plumbs dried and baked in an oven, or in the sun. The prunes chiefly used among us are black and large, brought from Bourdeaux: Great quantities are used by the English and Dutch. The juice of prunes is esteemed laxative.

COCOA, or *cacao*, is a kind of nut, about the size of a moderate almond; the seed or fruit of a tree of the same name, growing in several parts of the West-Indies. It resembles our cherry tree; but it is so very delicate, and the soil it grows in is so hot, that to guard it from

the sun, they always plant it in the shade of another tree, called mother of cocoa. The fruit is inclosed in a kind of pod, of the size and figure of a cucumber, except that it begins and ends in a point. Within the pod is formed a tissue of white fibres. In the middle of these fibres are contained ten, twelve, or even forty grains or seeds of a violet colour, and as dry as acorns. Each grain which is covered with a little rind, separates into five or six unequal pieces, in the middle whereof is a kernel, having a tender bud, very difficult to preserve.

Of this *seed*, with the addition of other ingredients, the Spaniards, and after their example the rest of Europe, prepare a kind of conserve or cake, which when diluted in hot water, makes a delicious and wholesome drink, called *chocolate*.

Some Spaniards make five thousand pounds per ann. from a single garden of cocoas.

In some parts of America, the cocoa grains are used by the Indians as money, twelve or fourteen, are esteemed equivalent to a Spanish real, or six-pence three farthings sterling.

POMEGRANATE; a fruit in form of an apple or quince, full of seeds or kernels, inclosed within a reddish pulp, sometimes sweet, sometimes acid. It is so called from the abundance of its grains or kernels; q. d. *pomum granatum*, a kernelled apple; or from the country where it was anciently produced, viz. Granada.

The trees never grow high; their branches are a little prickly; their leaves resemble those of the great myrtle; and their fruit which is composed of red, angular grains, are all inclosed in little distinct cells.

Pomegranates are not only agreeable to the taste, but good for the stomach, and of considerable use in medicine.

Of the *kernels* are made syrups and conserves, but there is very little of the true fold.

FIG; a soft, delicious fruit, the produce of a tree of the same name. Figs are of divers kinds, the black, and the violet coloured are the worst: The white are esteemed the best. They are dried either by the furnace

nance or the sun, and in this state they are used both as medicine and food. The best figs are the produce of Italy, Spain, Provence, &c. And the islands of the Archipelago yield figs in great abundance, though inferior in goodness to those of Europe. The Greeks in those islands cultivate them with wonderful care and attention; as making the principal food, and a considerable part of the riches of the country.

Figs are gathered in autumn, and generally laid on a rack, or hurdle, to dry in the sun. They are found to contain much phlegm, a little salt, and some oil. They are very nourishing; and they are used to make gargarisms against disorders of the throat and mouth: They are also applied externally, to soften, and promote maturation.

RAISINS, are grapes prepared by drying them in the sun, or in ovens, to fit them for keeping, and for some medicinal purposes.

There are various kinds; as raisins of Damascus; they are brought to us flat and seeded, of the size of the thumb, whence we may judge of the extraordinary bulk of the grape when fresh. Travellers mention bunches that weighed twenty-five pounds. Their taste is faintish and disagreeable.

Raisins of the sun, are a kind of grapes brought from Spain, of a reddish, or blueish colour, seeded, very agreeable to eat. There are various other sorts, and denominated from the place where they grow, &c. As the raisins of Calabria, Muscadine raisins, &c.

CURRENTS, are so called, because formerly coming from the Isthmus of *Corinth*. They come from several other places of the Archipelago. The little Spanish currants are sometimes sold for them. They are a kind of little raisins or dried grapes, of different colours, red, white or black. They must be chosen new, small, and in large masses. When made up in bales they may keep two or three years, without stirring or giving them air.

Sir George Wheeler's account of these fruits and the manner of preparing them is curious. He observes the

island of Zant is the chief place whence currants are brought: the Morea, or the Isthmus of Corinth, which was anciently the principal plantation, and whence the Latins denominated them *uva corinthiaea*, now produces no more, having been much neglected: the jealousy of the Turks not allowing large vessels to enter the gulf, to take them off their hands.

They do not grow on bushes like our gooseberries, though that be the common opinion; but on vines like our grapes; except that the leaves are somewhat thicker, and the grapes smaller; they have no stone. They gather them in August, dispose them in couches, on the ground till dry, then clean them, and lay them up in magazines. They cling so fast together by their own weight, that they are forced to be dug out with iron instruments.

To barrel them for sending abroad, they have people to tread them close, that they may keep the better. They pay a considerable custom to the states of Venice. Zant produces enough yearly, to load five or six vessels; Cephalonia, three or four; and the other islands one. None of Zant knew but little of the use we make of them.

DATES; the fruit of the palm tree. This fruit is gathered in autumn, ere ripe, and bears a near resemblance to our bullace; being of a green colour, very sharp and astringent. When ripe it becomes ruddy, having a hard long stone, cloven at bottom, encompassed with a thin white skin.

The word is formed of *dactyl*, and that of *dactylus*, finger: as being round and oblong, resembling a finger's end.

The husk or covering of the date, when the fruit is in flower, is variable; having as many changes of colour as the fig has. Some dates are black, some white, some brown, some again are round like apples and very big. Ordinarily they are oblong, fleshy, yellow, somewhat bigger than the thumb's end, and very agreeable to the taste. Some are no bigger than a pea, and others as big as a pomegranate. The best are those called royal dates. There is also another sort called *Caryotæ*; which

which are very good: Some of them have stones and others none.

Dates are principally used in medicine; their qualities are to soften the asperities of the gullet, to alluage immoderate fluxes of the belly, and to ease disorders of the veins and bladder. Their bad property is that they digest with difficulty, cause pains in the head, and produce a thick melancholic blood. These effects arise from the principles they contain, which are *oil*, phlegm and salt. People who live upon dates become scorbutic and loose their teeth betimes.

Our dates are brought us from Egypt, Syria, Africa, and the Indies. They never come to full maturity in Italy, or the more southern parts of Spain. And yet there are tolerable dates in Provence; only they breed worms and do not keep.

Those from Persia exceed all others in largeness, colour and taste.

The APPLE-TREE need not be described. Dr. *Linnaeus* has joined the pear, apple and quince together, making them all of the same genus, but *Miller* has not followed that order. He separates the apple from the pear, according to the practice of other Botanists. He enumerates various kinds of apples, and mentions that the following are preferred for the making of cyder, viz. The Red-streak, the Herefordshire underleaf; the Devonshire Royal wilding, the Whitesour, the John-apple, the Everlasting-hanger, the Gennet-moyle, &c.

Some years ago the *transparent-apple* was brought to England, from Petersburg, and was esteemed a curiosity. It was said to be so transparent that the kernels might be perfectly seen, when the apple was held to the light; but in this country it is a mealy insipid fruit; so not worth propagating. The *golden-rennet* ripens about Michaelmas, and for about a month is a very good fruit, either for eating raw, or baking. The *nonpareil* is a fruit generally known, though there is another apple, according to *Miller* that is often sold in our markets for it. It is seldom ripe before Christmas, and when well preserved will keep perfectly sound, till May. This is justly esteemed one of the best apples that have been yet known.

The *Fig-apple* is supposed by many persons to be produced without a previous flower. In the *Phil. Trans.* is a letter written by *Paul Dudley, Esq.* where he gives an account of this tree, and describes it as exceeding large, and producing great quantities of fruit without any previous blossom. But some again affirm that a small flower is seen to precede the fruit, though very fugacious, and seldom continues above a day or two.

The *paradise-apple* hath, of late years been chosen for stocks to graft or bud upon, but these are not of long duration. They have been much more esteemed in France, where they were frequently brought to the table in the pots, growing with their fruit upon them. But this being a curiosity it never obtained much in England.

The first apple that is brought to market is the *codlin*, and the next is the *margaret-apple*. The *golden-pippin* is a fruit peculiar to England: There are few countries abroad where this succeeds well, nor do they produce so good fruit in many parts of England as were to be wished. This is in some measure owing to their being grafted on free stocks. They should be always grafted on the crab-stock, which will not canker like the others, and though the fruit will not be so fair to the sight, yet it will be better flavoured.

The *royal-russet* is a large fair fruit, and is one of the best kitchen apples we have. The tree is a very great bearer, and grows large and handsome, and the fruit is in use from October till April, and is a pleasant fruit to eat. *Piles russet* is very much esteemed for baking.

Loan's pearmain, is a beautiful fruit of a middling size. The side next the sun is of a fine red, and striped with the same colour on the other. The flesh is vinous, but as it soon grows mealy, it is very greatly esteemed.

PEARS; *Miller* enumerates eighty kinds, and observes there are many others.

The pear which in England is commonly termed *Fargonelle*, is very long, of a pyramidal shape, the flesh of this pear is breaking, and has a rich musky flavour; ripe in the middle of July. It is one of the best early summer

summer pears yet known. The *summer-bergamot*, by some called the Hamden's bergamot, is a pretty large round, flat pear, of a greenish yellow colour, and hollow a little at both ends like an apple; the flesh is melting, and the juice is highly perfumed. The *autumn bergamot* is a smaller pear than the above, but nearly of the same shape, it is a great bearer and ripens the middle of September; its juice, like the former, is richly perfumed and its flesh melting, and it is one of the best pears of the season. There are other excellent kinds of the bergamot. The *red, grey, or green butter pear* is a large long pear; the flesh is melting, and full of a rich sugary juice. It ripens the end of September, and when gathered from the tree, is one of the very best sort of pears we have. The *Poire de livre*, or *pound pear*, called also the *poire d'amour*, or the *lovely pear*, and in England the *black pear of Worcester*, is a very large pear, each of which commonly weighs a pound, or more. This is not so fit for eating, but bakes or stews remarkably well. The *German-muscat* is an excellent pear, more long than round. It is buttery, melting, and a little musky. This is in eating in March, April, and sometimes in May. There are many other sorts equally excellent. In describing the various kinds of fruits, there is a considerable difficulty; as the same kinds go under different names in different countries, and even in different parts of the same country.

QUINCE.—There is the pear-quince, the apple-quince, the common quince, &c. Six kinds are cultivated in the nurseries near London, but the Portugal kind is most valued for the goodness of its fruit. The quince-tree is easily propagated, either by layers, suckers, or cuttings, which must be planted in a moist soil. After the second year they must be managed like the apple trees. They thrive best by the side of a ditch or river, producing a greater plenty of fruit, and of a much larger kind; though those in the dry soil will be better tasted, and much earlier ripe.

The tree is of a low stature; the flower and fruit are like that of the pear tree; but however cultivated, the fruit is sour and astringent, and is covered with a kind of down.

PINE-

PINE-APPLE.—This fruit is justly esteemed for the richness of its flavour, as it surpasses all the known fruits in the world. The tree is supposed to have its name from the cones of the pine-tree, which the fruit somewhat resembles. It is hard to determine where this plant is a native; it is probably an indigenous plant in Africa, where they are said to grow in uncultivated places in great plenty. They have been long cultivated in the hottest Islands of the West Indies, where they are in great plenty and extraordinary goodness. They have been but lately introduced into our European gardens, so as to produce fruit; and the first person who succeeded in this affair was *Monseigneur le Cour* of Leyden, who, at length, after many trials, hit upon a proper degree of heat and management, which produced fruit as good, though not so large, as those in the West-Indies. From him our gardens in England were first supplied. The most common kind in Europe is the oval shaped pine-apple, with a whitish flesh; but the pyramidal pine-apple, with a yellowish flesh, called the sugar-loaf pine-apple, is, by far, more preferable, being larger and better flavoured, and it may be eaten in greater quantity, with less danger. This is likely to be, in a few years, the most common sort in England. The green pine-apple is the most rare in Europe, though esteemed the best sort in America.

PEACH. A good peach ought to have a firm flesh, the skin should be thin, of a deep or bright red colour next the sun, and of a yellowish cast next the wall; the flesh should be high flavoured, full of juice; the stone small, and the pulp or flesh very thick. When a peach hath all these qualities, it may be esteemed a valuable fruit. *Miller.*

All the different sorts of peaches have been originally obtained from the stones; which being planted produce new varieties. The French distinguish those we call peaches, into two sorts; viz. *pavies* and *peaches*, the former they make the male, the latter the female. The flesh of the *pavies* adhere to the stone, and those are called peaches which quit the stone. The *Pavies* are much more esteemed in France; the peaches are generally preferred in England. *Miller* enumerates thir-

by one kinds, but prefers the following. The early purple ; the Grose Mignon; Belle Chevereuse ; Red Magdalen ; Chancellor ; Bellegarde ; Bourdin Rossanna ; Rambouillet ; and Nivette. The Catharine Peach is an excellent fruit.

NECTARINE. This fruit comes under the order of peaches, to which it properly belongs, differing in nothing but the smooth rind, and in the flesh being firmer. The French call this fruit *Brugnon*. The early nectarine is of a beautiful red colour, and well flavoured ; it is one of the earliest sorts, ripening about the middle of July. The Newington Nectarine has an excellent rich juice : this ripens about the beginning of August, and is the best flavoured of all the sorts. The Golden Nectarine is a fair, handsome fruit, and of a rich flavour, it ripens about the beginning of September. There are other sorts very excellent. The culture of the Nectarine differs in nothing from the peach.

MEDLAR. There are seven species. The German *Mespilus*, or common medlar, rises with a deformed tree stem, fifteen or twenty feet high, bearing large roundish, brown fruit, the size of middling apples, which ripen in October, but are not eatable till they begin to decay ; for when firm and sound they have an austere and disagreeable taste. Of this kind the other varieties are the small Nottingham medlar, and spear shaped Italian medlar. These species are all cultivated in the English gardens. The Nottingham kind, though a smaller fruit than the German or Dutch medlar, is rather preferable for poignancy of flavour, and richness.

When gathered they may be laid in moist bran which will hasten their decay. Those laid in straw will not be so soon fit for use ; but will be ready in due succession.

CAPER ; the bud or blossom of a shrub of the same name, gathered green, before it expand into a flower : It is afterwards dried in a dark place till withered, and then infused in vinegar, and at last, salt is added : It is then put into barrels to be used as a pickle, chiefly in sauces ; but sometimes also in medicine, as being very
aperitive

apertive, or that has the quality of opening the body. Almost all the capers throughout Europe are brought from about Toulon in France; some few small salt capers come from Majorca, and a few flat ones from about Lyons.

The bark of the caper-tree, when dried, is prescribed, by the French physicians in oppilations (obstructions) of the spleen.

WINES, LIQUORS, &c.

The principal wines drank in Europe are as follow :

1st. The Madeira Island, and Palma, one of the Canaries, afford two kinds; the first called *Madeira sec*; the latter, which is the richest and best of the two, *Canary*, or *Palm sec*. The name *sec* (corruptly written *sack*) signifies dry; those wines being made from half dried grapes. There is another sort of *sec wine*, prepared about Xeres, in Spain, and hence called, according to our orthography, *Sherris*, or *Sherry*.

2d. The wines of Candia and Greece are of common use in Italy. *Malmsey* was formerly the produce of these parts only, but is now brought chiefly from Spain; it is a sweet wine, of a golden or brownish yellow colour, and to this is applied an Italian proverb, *manna to the mouth and balsam to the brain*. Italy produces the *vino Greco*, which is a gold coloured unctuous wine, the growth of mount Vesuvius.

3d. Most of the Spanish wines are composed of fermented or half fermented wine, mixed with inspissated must, and variously manufactured, or of an infusion of dried grapes in weak must. Of these wines there are a few in Germany, as the *Alicant*, which is a thick, strong, very sweet, and almost nauseous wine. *Sherry*, *Spanish*, *Malmsey*, &c. are of this kind.

4th. From Portugal comes plenty of red port, which is much drank in England. The best *vino tinto*, a blackish red wine, used by the coopers for colouring other wines, is said to be the produce of Portugal. This kingdom also deals largely in Madeira.

5th. The

5th. The most celebrated of the *French wines* are *Champagne*, *Burgundy*, *Vin de beaune* or *partridge-eye*, *Frontinac*, *Hermitage*, &c. Among the more esteemed *German wines* may be reckoned *Rhenish*, *Mayne*, *Moselle*, and *Neckar*. A certain writer calls the *Rhenish* made in *Hockheim*, (*Hock*) the prince of the wines of *Germany*. Besides these wines above-mentioned, there are various others.

There is a sort of *malmsey wine*, made by boiling of *muscadine*.

Method of making and fining wine.—In the southern parts of *France*, their way is for *red wines* to tread, or squeeze the grapes between the hands; after the juice and husks have stood a time they press them; but for *white wine* they press the grapes immediately. When pressed, they tun the must and stop up the vessel, leaving the depth of half a foot or more empty, to give room for it to work. About *Paris*, and in the northern parts of *France*, they let the *must* and *must* stand two days and nights for *white wines*, and at least a week for *claret wines* before they tun it. To fine it down, they put shavings of green beech into the vessel.

Although the juice of the grape is replenished with generous spirits, sufficient for fermentation, yet, it is usual in some countries, to put quick-lime either upon the grapes when they are pressing, or in the must, that by the force of its saline and fiery particles, the liquor may be both accelerated and assisted in working.

If after the first fermentation, certain impurities remain, *Wine-coopers* put into it things to help its clarification, as *ising-glass*, *whites of eggs*, *powders of alabaster*, *calcined flints*, *rock-alum*, &c.

The *Grecians* promote the *fining* of their strongest wines by a quantity of *sulphur* and *alum*. But of all the ways of hastening the ripening and clarifying of wine, none seems more easy, or less noxious than that borrowed from one of the ancients, by *Lord Bacon*; which is by putting the wine into vessels well stopp'd and letting it down into the sea. Some sweeten their wines with *raisins of the sun*.

For *English wine*, the method recommended by *Mr. Miller* of spreading the grapes upon wheaten

wheaten straw in a large dry room, and thus exposing them to the air for a fortnight or more, seems worth notice. By this method he assures us he has made English wine as good as any of the best and purest French wines drank either in Paris or Champagne.

Dr. *Boerhaave* observes of wine, that the first thing it affords by distillation is a thin, fatty, inflammable fluid, called a spirit; and in this it is distinguished from another class of fermented vegetable juices, viz. vinegars, which instead of such a spirit, yield an acid unflammable matter. In the making of wines, the nature of fermentation should be well understood.

Fermentation is a change produced in vegetable bodies by means of an intestine motion; and the effect is, that the part which first rises from them in distillation is either a thin, fat, acrid, hot, transparent, volatile, and inflammable fluid that will mix with water; or else a thin, acid, pellucid, less volatile, unflammable liquor, capable of extinguishing fire.

We see then that there are *two different effects* of fermentation; the production of an inflammable spirit, and an unflammable acid. This fermentation can only take place in the *vegetable kingdom*; for all the art in the world, so far as hitherto appears, will never gain such spirits from animals or fossils, and consequently never excite an actual fermentation in them: For fermentation is the single operation in nature, by which such spirits can be obtained.

Any liquor so fermented as to afford the inflammable spirit above-mentioned, we call wine; and under the name wine, include beer, ale, mead, cyder, perry, &c. Vinegar is also obtained from all the same bodies that afford wine, such as grapes, currants, mulberries, cherries, &c. all sorts of grain, as barley, wheat, oats; pulse, as beans, peas, tares, &c. and from roots as turnips, carrots, radishes, and in short, from all sorts of vegetable substances, even grass itself.

Maturity is necessary for those fruits designed for fermentation. The juice of unripe berries will scarcely ferment at all; though when fully ripe, fall spontaneously into fermentation. Thus the juice of unripe grapes, being incapable of fermenting is a rough acid liquor

liquor called verjuice, that will for many years remain in the same inactive state ; but grapes come to maturity can no sooner be pressed into a vessel than it becomes a fermentable spirituous fluid. There is another requisite for fermentation. It must contain only a *moderate proportion of oil*, for if it either exceeds in the quantity, or be entirely destitute of oil, it will never be brought to ferment at all. Thus Almonds, Fennel-seeds, &c. are always deprived of their oil, before they are attempted to be fermented. Bodies to be fermented must first be converted into a fluid state, or dissolved in water ; hence honey can never be made to ferment, while it retains its native thick consistence, but being dissolved by heat or let down with water, it immediately enters the state of fermentation : while the juice of grapes, if boiled to the consistence of a jelly will lie quiet and never ferment at all, till again diluted by water.

Mere-goute, Mother-drop ; is the virgin-wine, or that which runs of itself out of the tap of the vat, before the grapes have been trodden in the vat. *Boisson*, or draught-wine, is made of the husks, left of the grapes which are called rape or marc, by throwing water upon which, and pressing afresh they make a liquor for servants.

The *goodness* of wine consists in its being net, dry, clear, fine, brisk, without any taste of the soil, of a clean steady colour ; in its having strength without being heady, a body without being sour, and its keeping without growing hard.

CIDER, or Cyder, is a brisk, tart, cool liquor, prepared from Apples. The manner of making cider is easy and simple. The fruit is first ground in a mill, and the juice is then squeezed out into a press ; some then strain the liquor through a filter, and tun it up in Hog-heads or other vessels. For some time it remains unstopped to work and ferment, afterwards it is stopped close. A small quantity is now from time to time drawn out till it be supposed pretty clear. It is then pierced to prove its fineness ; the summer fruit after a month ; the gennet-moil after the first frosts ; the red-

break not till after January ; and the winter fruits about the same time.

If it be not now found fine enough, it stands longer, and if still defective, it is racked off like wine ; or fined with ising-glass, &c. The liquor when once fine, is drawn out, or bottled off, as occasion requires.

It may be observed that a mixture of fruits is a great advantage to cider ; the worst apples mixed together, make as good cider as the best alone ; always observing however, that they be of equal ripeness.

Some that have not cider-mills, pound the apples in a stone mortar, but the kernels and stalks being bruised with them, give the liquor an ill flavour.

PERRY is a drink made of pears, after the manner of cider, from apples. The best fruit for this use, are such as are least fit for eating, as the horse-pear, boreland-pear, choak-pear, bosberry-pear, &c. The method of preparing perry is the same with that of cider, but it must be observed that the fruit should be fully ripe.

VINEGAR is an agreeable, acid, penetrating liquor, prepared from wine, cider, beer, and other liquors, and it is of considerable use, both as a medicine, and a sauce.

The word is French, *vinaigre* ; formed from *vin*, wine ; *aigre*, sour.

Wine, and other vinous liquors are said to gain a grateful sharpness, i. e. to become vinegar, by having their salts exalted by insolation, or other means ; and their sulphurs weakened and depressed.

The method of making vinegar was long kept a secret, among the people of that profession, who it is said obliged themselves to each other by oath not to reveal it : but notwithstanding this the *Philosophical Transactions*, and some other late writings furnish us with approved accounts thereof.

For *Cider Vinegar*. Draw off a quantity of *must* of apples, and set the whole in the sun for a week, nine days or longer, and it may be drawn off for future use.

RUM

RUM is, according to *Chambers*, a species of brandy, or vinous spirit, drawn by distillation from *sugar canes*. It is very hot and inflammable, and is in the same use among the natives of the sugar countries, as brandy is among us.

Distillation is the art or act of separating or drawing off the spirituous, aqueous, oleaginous, or saline parts by means of fire; and collecting and condensing them again by cold. The use of distillation is very great, by which means, waters, spirits, essences, and extracts are chiefly made.

BRANDY, properly denotes a proof spirit, obtained by simple distillation from real wines, or fermented juice of grapes. To distil brandy, they fill the cucurbit half full of the liquor from which it is to be drawn, and raise it with a little fire, till about one sixth part be distilled, or till they perceive that what falls into a receiver is not at all inflammable.

The liquor thus distilled the first time is called brandy, which spirit purified by farther distillation, is what we call *spirits of wine rectified*.

The greatest part of the brandies in use, and those too, the best, are prepared in France: Of the French brandies, those of Bourdeaux, Rochel, Cognac, Nants, and Poitou are the most esteemed, as being of a better taste, finer and stronger, and enduring the bubble proof longer than any of the rest. Those of Anjou, Touraine, and Orleans claim the second place.

Brandy makes a very considerable article in the French commerce in time of peace: the number of foreign vessels which are laden with brandy is incredible. Nants alone furnished 174000 gallons per annum, and Bourdeaux above twice as much; the other places in proportion.

Of brandy, both plain and rectified, are prepared various kinds of strong liquors, with the addition of other ingredients, sugars, spices, flowers, fruits, &c. which are afterwards clarified. Such are cinnamon-waters, anniseed waters, fennel waters, citron waters. A great part of these are brought from Montpellier; where they are supposed to be better prepared than any where else.

GENEVA, or **GIN**; the name of a compound water, procured from the berries of the juniper-tree, distilled with brandy or malt spirits. The French name of juniper berry is *genevre*, from which the word is formed. The original liquor was formerly prepared differently from that now in general use, which is made from an ordinary spirit distilled a second time with an addition of some juniper berries. It was a custom in distilling spirits from wort, or other fermented liquors, to add in the working some aromatic ingredients, such as ginger, grains of paradise, &c. to take off the bad flavour, and to give a pungent taste to the spirit. Among other things used with this intent, some persons used juniper berries, and finding they gave not only an agreeable flavour, but very valuable virtues to the spirit, it became general, and the liquor sold under this name. The method of adding the berries was to the malt, in the grinding: a proper proportion was allowed, and the whole was reduced together, and worked in the common way. The spirit thus obtained was flavoured with the berries, and exceeded all that could be made by any other method. But our common distillers leave out the juniper-berries entirely from the liquor they now make and sell under that name. Our chymists have let them into the secret, that the oil of juniper-berries and that of turpentine are very much alike in flavour, though not in price, and the common method of making what is called *geneva* in London, is with common malt spirit, and a proper quantity of oil of turpentine distilled together. *Shaw's Essay on Distil.*

ARACK; a spirituous liquor, imported from the East Indies, used by way of dram, and in punch. The word arack, according to Mr. *Lockyer*, is an Indian name for strong waters of all kinds, for they call our spirits and brandy English arack. But what *we* understand by the name arack, he affirms to be no other than a spirit procured by distillation, from a vegetable juice called *toddy*, which flows by incision, out of the cocoa-nut tree, like the birch-juice procured among us. Others are of opinion that the arack is a vinous spirit obtained by distillation in the East Indies, from rice, or sugar fermented with the juice of cocoa-nuts. The

The *Goa* arack is said to be made from the toddy; the *Batavia* arack from rice and sugar; and there is likewise a kind of shrub from which arack is made.

There is a paper of observations on arack in the *Mélanges d'Histoire Natur.* By fermenting, distilling, and rectifying the juice of the American maple, which has much the same taste as that of the cocoa, the author says he has made arack not in the least inferior to any that comes from the East Indies; and he thinks the juice of the sycamore and of the birch would equally answer the end.

ALE is a popular beverage, or drink made from malt. The *zythum* and *curmi* mentioned by *Tacitus*, as the beverage of the ancient Germans, are supposed to correspond to our ale and beer.

Malt, denotes *barley* cured, or prepared to fit it for making a potable liquor, under the denomination of beer, ale, &c. *Brewing* is the operation of preparing ale or beer from malt. The process may be so easily known to any one, that a particular description herein would be unnecessary, were it not the professed design of this work to convey some leading ideas of useful labours in general.

In brewing, a quantity of water being boiled, is left to cool till the height of the steam be over; when it is poured to a quantity of malt in the mashing tub and well mixed, after standing some time a second quantity of water is added and then a third, and stirred up as before, this operation is called mashing. The whole now stands two or three hours, more or less, according to the strength of the wort, and is then drawn off into a receiver. The mashing is repeated for the second wort nearly in the same manner as for the first. After these worts are mixed, a quantity of hops are added, and the liquor is again boiled. The hops are afterwards strained from it, and when it is cool the barm or yeast is applied. The barm causes the whole to ferment, and when sufficiently fermented it is tunned up in vessels for use. One, two, three, or more months are necessary to pass before it will be of due age for use. Instead of yeast,

Some use castile soap, others flour and eggs, others an essential oil of barley, and others the *sal panaris*lus.

The manner of making malt, *Sir Robert Murray* describes as follows. Steep good barley in a stone trough full of water, till the water be of a bright reddish colour, but it may be known when it is steeped enough by other marks, as by the excessive swelling of the grain, and by too much softness. It is afterwards taken out, and laid on heaps to let the water drain from it, then turned and laid in a new heap, where it may lie forty hours, more or less. In about fifteen or sixteen hours the grains put forth roots, which when they have done, the malt must be turned over, otherwise the grains will begin to put forth the blade or spire, which must be prevented. It must be now spread to a depth not exceeding five or six inches, and then turned over and over, and thus for the space of forty-eight hours at least. This cools, dries and deadens the grain, whereby it becomes mellow, melts easily in brewing, and separates entirely from the husk. Then throw up the malt into a high heap, and let it grow as hot as your hand can endure it, which it usually does in about thirty hours space. This perfects the sweetness and mellowness of the malt. It is now again cooled and turned over, and then laid on a kiln, with hair-cloth or wire spread under it, where, after one fire, it must have a second and perhaps a third before the malt be thoroughly dried. The best and most natural method of drying malt, is in the sun, in the months of April and May. This yields the palest, the most wholesome and the finest liquor.

Malt drinks are either pale or brown, as the malt is more or less dried on the kiln; that which is the least dried tinging the liquor least in brewing, and therefore called pale, whereas the higher dried, and as it were roasted, makes it of a higher colour.

Hops preserve the liquor: if hops were not added, that clammy sweetness which the liquor retains after working, would soon turn it acid, and unfit for use.

AROMATIC

AROMATIC SPICES, GUMS, RESINS, &c.

FRANKINCENSE, is an odoriferous aromatic gum or resin, anciently burnt in Temples as a perfume. It distils from incisions made in a tree called *Arbor Thurifera*, during the heat of summer. But for all the great use of this gum, both in the ancient religion and the modern medicine; the tree is but little known.

The most common opinion has always been that it was brought from Arabia Felix, and was found near the city of Saba; whence its epithet *Sabæum*; and yet the name *Olibanum* which it sometimes bears, seems to intimate that there are thuriferous or incense-bearing trees in the Holyland, near mount Lebanon. And travellers are positive that there are others in the East Indies.

Nor are we less at a loss for the form or kind of tree from which it flows. *Pliny* says that it at first resembles the pear tree, then the massic tree, then the laurel; but that it is in reality the turpentine tree; but some of his accounts are not to be altogether relied upon.

Frankincense is distinguished into male and female, male incense, or olibanum, is in fair white bits, or tears, a little yellowish, of a bitter disagreeable taste, and when chewed promotes the flux of saliva. It is called male on account of its tears which are larger than the common, or female.

That brought from the Indies, is not thought to be so good as that from Arabia, or mount Lebanon: It is sometimes called incense of Mocha, though it be not brought from that city. It is usually in a mass, but sometimes in drops or tears, somewhat reddish; and some sell it for the true *Bdellium*.

Incense is used in various chymical preparations; it warms, dries and binds; and is used not only in divers diseases of the head and breast, but in vomitings, &c. Externally it is applied to strengthen the brain, and heal wounds.

There is a bark brought from the Indies, called *bark of incense*, and sometimes *Jews incense*, as the Jews make

make frequent use of it in their perfumes. *Manna of incense*, is the flower or farina of incense, occasioned by the friction of the grains against each other, in the sacks wherein they carry it.

There is also a *foot* of incense, which is a preparation of it, burnt like resin to make lamp-black.

Frankincense was formerly burnt in the temples of all religions, to do honor to the divinities that were there adored. Many of the primitive Christians were put to death, because they would not offer incense to idols. In the Romish church they still retain the use of incense in many of their ceremonies.

Bdellium is an aromatic gum, brought from the Levant, of some use both as a medicine, and a perfume. Concerning this gum there is much uncertainty; there is mention made of it in scripture, and among the ancient naturalists, but it is doubtful whether any of these be the same as the modern kind.

SPICE.—This name includes any kind of aromatic drug, that has hot and pungent qualities, such as pepper, nutmeg, ginger, cinnamon and cloves. Some also apply the word to divers medicinal drugs brought from the East, as senna, cassia, frankincense, &c.

CLOVE; a fruit, from a tree of the same name. The fruit is somewhat in form of a nail; whence the term *clove* from the French *clou*, a nail. The clove tree was anciently very common in the Molucco islands, where all the European nations who traffic in spices, furnished themselves. At present there are scarcely any but in the island of Ternate. The Dutch, in order to make themselves masters of that merchandise, having dug up the clove trees of the Moluccos, transplanted them to Ternate, so that there are none now to be had but through their hands.

The tree is very large; it only bears fruit once in eight years, but holds at this rate, an hundred. Its bark resembles that of the olive tree, and its leaves those of the laurel, its fruit falling takes root without any culture. It is said it will not allow any other herb or tree near it; its excessive heat drawing to it all the humidity of the soil.

When

When the clove first begins to appear, it is of a greenish white colour, as it ripens it grows brown. Nor is there any preparation necessary in order to render it such as it comes to us, but to dry it in the sun; though some authors signify that it is first steeped in sea-water to preserve it from the worms.

Cloves must be chosen dry, brittle, harsh to the touch, well grown, of a dusky red colour, a hot aromatic taste, an agreeable smell, and if possible with the shank on.

Their properties are to warm and dry, to correct a fetid breath, sharpen the sight, dissipate films in the eyes, fortify the stomach and liver, and stop vomiting. They are of use in apoplexies, palsies, lethargies, and other diseases of the brain.

Such of the fruit as escape the gatherers, grow and swell on the tree, and become full of a gum used in medicine called *mother of cloves*.

There is an oil drawn from cloves, by distillation; it is used as a sovereign remedy for the tooth-ach, and in compositions with the same view as the fruit. It is also much used among the perfumers.

NUTMEG; a delicate kind of aromatic fruit, or spice brought from the East-Indies; of which there are two kinds, male and female. The *female* is that chiefly used among us; its form is round, its smell agreeable, and its taste hot and pungent. The male is a *wild nut*, of a longish form, and without either taste or smell; yet sometimes sold, while in the pod, for the female.

Nutmegs are inclosed in four different covers; the first a thick husk, like that of our walnuts. Under this lies a thin reddish coat, of an agreeable smell, and aromatic taste called *mace*; by others, though improperly *flower of nutmeg*. This wraps up the shell, and opens in proportion as the pod grows. The shell which makes the third cover is hard, thin and blackish, under this is a greenish film of no use, and in this is found the nutmeg, which is properly the *kernel* of the fruit. Every nutmeg has a little hole in it, which some ignorantly take for a defect.

The

The best nutmegs are those gathered in April. They must be chosen heavy, of a whitish brown colour, well marbled without side, reddish within, having a fat unctuous moisture, and an agreeable smell.

Nutmegs comfited green, are excellent to fortify the stomach, and restore the natural heat. They are particularly esteemed carminative. The whole commerce of nutmegs is in the hands of the Dutch East-India Company.

The nutmeg-tree is propagated after a particular manner. *Tavernier* tells us that the birds, devouring the nutmeg when ripe, gives it back whole by stool and that thus falling to the ground, besmeared with a viscid matter, it takes root, and produces a tree.

PEPPER, is well known from its general use; it is defined an aromatic fruit, or berry, of a hot dry quality. It is the produce of a shrub growing in several parts of the East-Indies, chiefly Java, Sumatra, Malacca, and the coasts of Malabar. The plant is very weak, and of the reptile kind, and for that reason usually planted at the foot of the larger trees.

Pepper grows in bunches or clusters; at first green, and as the grain ripens they grow red; and at last, after being exposed awhile to the sun, become black in the condition we see them.

The fruit is gathered in November. It must be chosen large, full, not wrinkled, without dust, with a good many white grains in it; and care be taken that the largest berries have not been taken out, to make white pepper. The *white pepper* is the fruit of the same plant with the black, and is prepared from it by moistening it with the sea water, and then exposing it to the sun, and casting away the outer bark, the grains are left white.

Some authors, and among the rest, *Pomet*, will have the white pepper to be natural, and the fruit of a different plant from the black; but *M. Dellon* expressly declares the contrary, from his own long experience.

White pepper must be chosen after the same manner as the black, with this further care, that it hath not been dyed white. Pepper that is sold ground, is apt to be

be sophiscated ; the black with burnt-crust of bread, and the white with beaten rice.

Long pepper is so denominated from its form, which in length and thickness equals a child's finger. It consists of an assemblage of grains, closely joined together, and grows by a long pedicle to a plant like that of the black. Of this pepper there are three kinds, that of the East-Indies, that of Ethiopia, and of America. The first is alone the proper long pepper, the rest resembling it but little.

Guinea pepper is a reddish pepper, much esteemed by the Americans, from whom it is brought. It is now cultivated in France, and used in making vinegar, and likewise comfited with sugar. It must be chosen new, in large pods, dry, entire, and red.

Jamaica pepper, called by the Dutch *amomi*, and by the Spaniards *pimienta de Jamaica*, is the fruit of the tree that yields the Indian wood. It grows plentifully in Jamaica and other American islands. It is really aromatic, and may supply the defect both of cloves, nutmeg, and cinnamon, whence it is called by the English *all-spice*. The French call it the round clove, from its taste resembling that spice.

This Jamaica pepper and the Guinea pepper are also called *Pimento*.

GINGER is an aromatic root, of considerable use both as a spice and a medicine. It is brought chiefly from Calicut in the East-Indies, though of late it has been cultivated with success in the Caribbee Islands. The plant which affords it resembles our rush both in flower and stem. The root goes no depth, but spreads itself near the surface, in form not unlike a man's hand, but very knotty.

When arrived at maturity they dig it up, and dry it on hurdles, either in the sun or an oven ; the best is that which is new, dry, well filled, hard to break, of a ruddy, brown colour without, resinous within, and of a hot, pungent taste.

They used to comfit the root, when green, with sugar and honey, having first steeped it sometime in water, to take away part of its acrimony, and dispose it to let

go the outer skin. They also make marmalade of it, and dry cakes.

The northern people make great use of this confection, as holding it sovereign against the scurvy. The Indians eat the root when green by way of salad, first chipping it small, mixing it with other herbs, and seasoning it with oil and vinegar.

As to its medicinal use, it is hot and penetrating; held good to strengthen the stomach and awaken appetite. It promotes digestion, prevents putrefaction, &c.

CAMPHOR is a white, shining, transparent, friable, inflammable, odoriferous, volatile gum or resin, of a bitterish taste, and very hot in the mouth, flowing from a tree of the same name, in the Islands of Borneo, Ceylon, and the neighbouring mountainous coasts of India; resembling a walnut tree. Camphor distils from the tree in manner of a gum, and it is said, most plentifully in the time of earthquakes and storms. *M. Lemery* says the camphor is found at the foot of the tree, where it thickens into little grains of different figures and sizes, very dry, friable, light, and of a bitterish taste. These little grains falling on one another, adhere lightly together, and form masses, which, being squeezed a little by the fingers, granulate again into small corpuscles, like salt.

Some authors make *two kinds*, according to the different parts of the tree where they are found. That in the veins of the wood is said to be different from that which oozes out from the bark. The camphor, it is said, being first red, is whitened either by the sun or the fire. In effect we have but little of the raw, natural camphor among us; the Dutch take care that it come all refined by sublimation, and prepared to our hands.

The manner of subliming is, to put it in subliming pots, and when half full, stop it and place it over a gentle fire. The purest parts rise first, but by degrees the whole is sublimed, except a *caput mortuum*, or earthy part which sticks at the bottom. Then they melt it with a gentle heat, and run it into moulds to give it what figure they please. Camphor has various uses. In the courts of eastern princes it is burnt with wax to illumine the night.

It

It is exceedingly inflammable, so as to burn and preserve its flame in water, and in burning it consumes wholly, leaving no scorium, or dross behind; but its principle use is in medicine. Camphor is the most efficacious diaphoretic, i. e. promoting perspiration. Its great subtilty diffusing itself through the substance of the parts, almost as soon as the warmth of the stomach has set it in motion. It is used in caries (rottenness) of the bones, and to resist gangrenes.

M. Lemery observes, that camphor dissolves perfectly in spirit of nitre, and is the sole resin that does so. This dissolution is called *oil of camphor*, and it is to this the medicinal virtue of camphor in wounds, gangrenes, and caries is ascribed. They use it not internally for fear of its sharpness, though M. Lemery has found good effects from two or three drops in the mouth, but generally mixed it with as much oil of amber.

It has been found in Ceylon that the root of the tree which yields cinnamon, yields by incision, a liquor that has a strong smell of camphor, and many of its virtues, whence naturalists, by mistake have supposed that all camphor came from that tree. There is also a smell of camphor in many other plants.

There is an *artificial camphor*, prepared with sandarach and white vinegar, kept twenty days in horse-dung, and afterwards exposed a month in the sun to dry, at the end of which it is found in the form of the crust of a white loaf. This is called juniper gum, white varnish, and mastic.

SPIKENARD; a kind of vegetable ear, growing even with the ground, and sometimes in the ground; warm, spicy, and cordial, and as such, used in the composition of venice treacle. The ear or spica is about the length and thickness of a finger, very light, covered with long, reddish hairs, of a strong smell, and a bitterish, sharp taste. Several of these ears rise from the same root, the stem is small, and the root the thickness of a quill. The *spica-nardi* is usually reckoned among the number of roots. It is also called *Nardus Indica*, because brought from the East-Indies. It is accounted a stomachic, nephritic, and carminative, or proper to
K strengthen

strengthen the stomach, promote the discharge of urine, and disperse flatulences.

CARAWAY ; a medicinal seed, produced from a plant of the same name. The seed is narrow, longish, and of a brisk aromatic taste. It is one of the greater hot seeds, and is esteemed stomachic and diuretic, dispels wind, and strengthens digestion. The English and Germans make great use of it, particularly in biscuits, comfits, seed cakes, and other foods and confections.

MANNA is a medicinal drug of great use in the modern practice, as a gentle purgative, and cleanser of the first passages. It is a sweet juice oozing from the branches and leaves of the ash tree, chiefly in Calabria, during the heats of summer. Manna has been commonly thought a kind of honey-dew, which, falling in the night, gathers on certain trees, and even on rocks and the earth itself, where it hardens with the sun. But what refutes this opinion is, that such dews melt in the sun, whereas manna whitens and hardens in it ; and such dews are only found on the tops and extremes of leaves, whereas manna lodges chiefly near the trunks of the branches ; and that the honey-dew falls only on trees open to the air, whereas manna is found in trees which are under cover, as was experienced by Dr. Corneli^{us}, who gathered manna from branches covered on purpose with cloth. And Lobeli^{us} assures us, that it has been gathered from branches of the ash, which had been thrown the day before into a cellar. Manna should therefore be ranked among the gums, which, exuding from the juice of the tree, and mixing with some saline particles of the air, is condensed into those flakes in which we see it.

The Italians gather three kinds, *manna de corpo*, which oozes spontaneously from the branches in July ; *manna forzata*, gathered in August, after an incision of the tree, when the flux of the first has ceased ; *manna di fronda*, which issues of itself, in little drops, like a kind of sweat from the nervous part of the leaves of the ash, and gathers into grains about the bigness of those of wheat, which are hardened by the sun in August.

gust. The leaves are frequently found so laden with these grains, that they seem covered with snow.

Manna is a gentle and safe purge : it is also used in broths. Though it is accounted a kind of honey, it purges the bile, whereas common honey increases it. Formerly the Syrian manna was in most repute, but now it gives way to the Calabrian. *Fuchsius* observes, that the peasants of mount Libanus eat manna ordinarily, as others do honey. At Mexico they are said to make a manna, which they eat as we do cheese.

The manna most esteemed is that in tears, which many take to be factitious, and the work of the Jews at Leghorn; but it is certainly natural; and what gives it this figure is, they put straws and slips of wood in the incisions, along which the manna gliding, is condensed as it comes out, and assumes this form.

Manna is also a *scripture term*, signifying a miraculous kind of food, which fell from heaven for the support of the Israelites; and *Salmasius* says, that their manna was no other than honey, or dew condensed; and that the one and the other were the same with the wild honey wherewith *St. John* was fed in the wilderness: so that the miracle consisted chiefly in the punctual manner in which it was dispensed by Providence, for so vast a multitude.

RHUBARB.—Two sorts are met with in shops: The first is imported from Turkey and Russia, in roundish pieces, freed from the bark, with a hole through the middle of each. They are externally of a yellowish colour, and on cutting, appear variegated with lively reddish streaks.

Rhubarb operates without violence, and may be given with safety, even to children. Besides its laxative quality, it is celebrated for an astringent one; it strengthens the tone of the stomach and intestines.

The Turkey rhubarb is with us universally preferred to the East-India sort, though for some purposes this last may be equally valuable: It is less aromatic, but more astringent. Tinctures are drawn from both. Of late, rhubarb has been cultivated in this country with

tolerable success, and is found not to be inferior, in medicinal purposes, to the foreign.

SPERMACETI is a whitish, flaky, unctuous substance, prepared from oil; principally from that of a fish, called the *male whale*, distinguished from the common whale, by its having teeth in lieu of whale-bone, and by a bunch on its back. It had its name *spermaceti* (seed or sperm of the whale) given it, no doubt, to raise its value, by notion of its scarcity. The oil it is properly to be made from, is found in a large trunk, four or five feet deep, and ten or twelve long, filling almost the cavity of the head, and seeming to supply the office of brain and cerebellum. The method of preparing it is a secret in the hands of a very few. The process is said to be thus; the matter being taken out of the animal, is melted over a gentle fire and put into moulds, like those wherein our sugar-loaves are formed. When cold and drained, it is taken out and melted over again; and this they continue to do till it be well purified, and become white. It is then cut with a knife for the purpose, and reduced into flakes such as we see it. Some of our druggists have now got the art of making it from the sediment or faeces of any kind of oil. It must be chosen white, clear, and transparent, of a sweetish smell, which some think like that of the violet; some sophisticate it with wax, but the deceit may be easily discovered. Some also sell a preparation of oil gained from the tail of the whale, instead of that of the brain. *Spermaceti* should be kept close from the air. It is of great use in medicines. *Quincy* says, it is a noble remedy in the asthma, though mostly used in bruises, inward hurts, &c. For internal use it may be dissolved in aqueous liquors, &c. But its greatest property is in softening the skin. Whence it comes to be used by the ladies in pastes, washes, &c.

Spermaceti candles are of modern manufacture. They are made smooth with a fine gloss, superior to the finest wax candles in colour and lustre; and when genuine, leave no spot or stain on the finest silk, cloth, or linen.

COCHINEAL

COCHINEAL and **TURMERIC** have been spoken of under the head of *colours*.

GUM-SENEGAL is a gum ordinarily sold by the druggists for gum-arabic, which it resembles very nearly as to form and virtue: it is either white, bordering on yellow, or of a deep amber colour, and transparent. It oozes out of a prickly shrub, common enough in Africa. The gum is brought to us from Senegal, whence its name.

GUM-ARABIC is the juice of a little tree growing in Egypt, of the cassia kind: It is very transparent, glutinous upon the tongue, and almost insipid to the taste. It is esteemed good to stop the pores, blunt the points of too pungent medicines, and temper the acrimony of trachea in coughs.

GUM-SANDARACH; a white gum oozing out of the trunk of the great juniper tree, by incisions made in the heats of summer. The small, or common juniper, yields very little sandarach. Its fruit yields oils, waters, salts, spirits, and extracts of some repute in medicine. This gum is an ingredient in varnish. It is melted in oil of turpentine, and is used by painters and cabinet-makers.

GUM-GUAIACUM, or, as it is called, a *resin*, is brought to us in large pieces, not unlike common resin, but very different in respect to smell, for when cast on the coals, it yields a very agreeable balsamic fume. This resin is drawn from the wood *guaiac*, which is medicinal, and comes from the East and West-Indies; and called *lignum vitæ*.

TRAGACINTH, or Gum-dragon, is a kind of gum, oozing out at incisions made in the trunk and larger branches of a plant or little shrub, of the same name, growing in the Levant. The plant is thorny. The naked hillocks of mount Ida in Candia, *M. Tournefort* tells us, produce much of it, which gives the gum spontaneously towards the end of June; this juice coagu-

lates in threads, passes through the bark, and becomes hardened by the air in little lumps, or into twisted pieces, in form of little worms. This gum dissolves easily in an aqueous menstruum: it is smooth and softening, and good to obtund the acrimony of any humours; which makes it of service in such coughs as proceed from defluxions of rheum.

DRAGON'S-BLOOD is the juice or resin of a large tree, called *Draco-arbor*, growing in Africa and America, as well as China. It dissolves with difficulty in any liquor, but very easily before the fire. It is a good astringent also to fasten the teeth and strengthen the gums. There is also a counterfeit dragon's blood, made of the gum of the cherry or almond tree, dissolved and boiled in a tincture of brazil-wood. *Pliny*, *Solinus* and others give an account of this gum, which is considered as fabulous. It derived its name from the redness of its colour, and gives the name dragon to the tree that yields it.

MUSK; a kind of perfume, of a very strong scent, and only agreeable when moderated by the mixture of some other perfume. Musk is found in a kind of bag, or tumour, growing about the bigness of a hen's egg, under the belly, towards the genital parts of a wild beast of the same name, and appears to be nothing more than a kind of bilious blood there congealed, and almost corrupted. The animal is pretty common in the kingdoms of Tonquin, Cochin-China, &c. but the most esteemed are those of the kingdom of Tibet. They inhabit the woods and forests, where the natives hunt them down; when the beast is killed, they cut out the bladder under the belly, separate the coagulated blood, and dry it in the sun, where it is reduced into a substance, almost of the nature of powder, of a dusky reddish colour, and acquires a very strong, disagreeable smell. It is then tied up again in bladders, and exported to other countries, and this is the musk we use.

What the ancients have wrote of it is fabulous, viz. that it comes from the testicles of a castror; and that, to
stop

stop the pursuit of the hunters, he castrates himself. The occasion of their error may be owing to this, that among the Indians, the musk animal goes by the name of castor.

Musk is in considerable use among the perfumers and confectioners, though much less now than formerly. It is supposed to fortify the heart and brain; and is good against deafness; but it is little used, as being apt to occasion the vapours. It affords the strongest of all known odours. *Tavernier* purchased 1663 bags, which weighed 1557 ounces. He brought one of the animals with him to Paris, the odour of which was so strong that it made every head in the house giddy.

It is sometimes adulterated by the peasants, who take out the real musk (or clotted blood) from the bag, and put in the place a mash of the animals blood and liver, which in time resembles musk.

STORAX is a resinous, odoriferous gum, brought from Syria. There are two or three kinds. Red or dry storax, called also Jew's incense, is a gum or resin, oozing out at an incision made in the trunk and biggest branches of a tree called storax, not unlike our quince tree. Its fruit is of the size of a filbert, and contains a white, oily kernel, of a smell perfectly like storax. It must be chosen in a mass, of a reddish colour, soft and fat, and of an agreeable smell, bearing no resemblance to liquid storax. That in cakes and balls is said to be all sophisticated, and only a wretched composition of liquid storax, and the impurities of the red storax and other drugs. That in powder is still worse. Red storax is of some use in medicine; and is also used by the perfumers, and often substituted for incense.

MASTIC, or Mastich, a clear and sweet resinous gum, issuing from the trunk and large branches of the mastic tree, either without or with incision. It has its name mastic, from *masticare*, to chew, being continually chewed by the Turks, especially by the women. Mastic is temperate in heat, and of a dry, binding quality; it strengthens the reins, and is a good cleanser.

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The jewellers mix mastic with turpentine and black ivory, and lay it under their diamonds, to give them a lustre. It is chiefly the product of Chio; the trees that yield it are cultivated with as much care as the vines. It brings in a considerable revenue to the grand Signior. There is also a kind of black mastic brought from Egypt.

TURPENTINE, is a transparent sort of resinous juice flowing either naturally or by incision from several trees, as the terebinthus, larch, pine, fir, &c. There are four kinds, the common turpentine, that from Chio or Cyprus, that of Venice, and that of Strasburg. All the turpentines are of a hot quality. They are sometimes given in internal ulcerations, and for cleansing the urinary passages. The common kind is seldom given internally, its principal use is in external applications, and among farriers. Turpentine is prescribed in diseases of the lungs and breast.

That of Venice is falsely so called; for though there was a turpentine anciently brought from Venice, yet that now so called comes from Dauphiné. It is liquid, of the consistence of a thick syrup, and whitish, and flows from the larch tree. That of Bordeaux is white and thick as honey. That of Strasburg is the produce of the silver fir.

Oil of turpentine, is sometimes given in doses of a few drops, in rheumatisms and fixed pains of the joints. *Cheyne* recommends it as a perfect cure for sciatics. *Boerhaave* says it must be used with great caution. — Painters mix it with drying oil, in their colours.

PITCH, Turpentine, &c. have been noticed under the article Pine, Larch, &c. It may be farther observed that pitch is *properly* a juice of the bark of the *pin*-cea or pitch-tree; and is conceived to be no other than the oil thereof inspissated and turned black, farther than in the balsam.

The method of drawing or procuring it, is by cleaving the tree into little billets, which they lay in a furnace, having two apertures, through one of which the fire is put, and through the other the pitch is gathered; which, oozing from the wood, runs along the bottom
of

of the furnace into basons, or receptacles placed for that purpose. The smoke which is here very thick, gives it the black colour. Some will have our common pitch to be the last running, and tar to be the first.

Wheeler gives us another method of drawing pitch used in the Levant ; a pit is dug in the ground, broad at top, and narrow as it becomes deeper, this they fill with branches of pine, cloven into shivers. The top of the pit is then covered over with fire, which burning down to the bottom, the pitch distils and runs out at a hole made therein. The finest and clearest pitch is called gallipot, and white pitch, and burgundy pitch. Of the same gallipot, is likewise prepared what we call *rosin*, by boiling the pitch to a certain consistence, and making it up in cakes. The black pitch, which is what we properly call pitch, some say is the liquid gallipot burnt, and reduced into the form and consistence we see it in, by mixing tar with it while hot. The best is that brought from Sweden and Norway. Its goodness consists in its being of a grossly, black colour, dry and brittle.

TAR.—Some modern writers inform us that tar flows from the trunks of pines and firs when very old, through incisions made in the bark near the root ;—that pitch is only tar inspissated and both are the oil of the tree, grown thick and black with age and the sun.

The trees, like old men, being unable to perspire, the secretory ducts seem choaked and stuffed with their own juice. It is prepared by other means also, and is obtained in Germany, in North America, and in all countries where there is much wood. The wood is enclosed in a large oven, to the quantity of ten or more loads at a time ; this stands within another oven, called the mantle, the space between them receiving the fire. From the bottom of the inner oven there runs a gutter, along which the tar runs, as it melts from the wood.

ISINGLASS is a preparation from the fish, *huso*. The word is Greek, formed of fish and glue. The method of making isinglass was long a secret in the hands of the Russians ; but hath lately been discovered. *Humphrey Jackson,*

Jackson, Esq. has published an account in the *Philosophical Transactions*. He observes that all authors have hitherto mistaken both the matter and preparation, and that *Pomet* has erred upon the subject. Our lakes and rivers in North America are stocked with immense quantities of fish, of the same species with those in Muscovy, and yields the finest isinglass, and the fisheries under due encouragement, would doubtless supply all Europe with this valuable article.

No artificial heat is necessary to the production of isinglass, nor is the matter dissolved for this purpose, for as the continuity of its fibres would be destroyed by solution, the mass would become brittle in drying and snap short asunder, which is always the case with glue, but never with isinglass. Mr. *Jackson* proves that isinglass is nothing more than certain membranous parts of fishes, divested of their native mucosity, rolled and twisted into certain forms, and dried in the open air. The air bladders of fresh water fish in general, are preferred for this purpose, as being the most transparent, flexible, delicate substances; and these constitute the finest sorts of isinglass.

The *book and ordinary staple* are made of the intestines of the fish. That called *cake-isinglass* is formed of the bits and fragments of the staple sorts. Isinglass is best made in the summer.

Prodigious quantities of fish that afford this article are found in the wolga and don, in the Caspian-Sea, &c.

Isinglass is sometimes used as a medicine, and may be useful in a thin acrimonious state of the juices.

AMBER; a solid, hard, semipellucid, bituminous substance, of a particular nature, of use in medicine, and in several of the arts. It has been in great repute from the earliest times. *Plato*, *Aristotle*, *Herodotus*, *Æschylus*, and others have commended its virtues.

The most remarkable property of this substance is that when rubbed, it draws or attracts other bodies to it; and this it is observed it does even to those substances which the ancients thought it had an antipathy to; as oily bodies, drops of water, human sweat, &c. By the friction it is brought to yield light pretty copiously in the dark. In

In the ground amber assumes all figures; as a pear, an almond, a pea; and there have been said to be letters found very well formed; and even Hebrew and Arabic characters. Within some pieces, leaves, insects, &c. have been found included; which seems to indicate, either that the amber was originally in a fluid state, or that having been exposed to the sun, it was once softened, and rendered susceptible of the leaves, insects, &c. which came in its way. All animals are extremely fond of it.

Naturalists have been greatly divided as to the origin of this substance, and what class of bodies it belongs to; some referring it to the vegetable, others to the mineral, and some even to the animal kingdom. *Pliny* describes it as a resinous juice, oozing from aged pines (others say poplars, whereof there are whole forests on the coast of Sweden) and discharged thence into the sea, where undergoing some alteration, it is thrown upon the shores of Prussia.

Some suppose amber a compound substance. *Mr. Brydone* in his tour to Sicily and Malta, says that the river Gearetta, formerly called Simetus, throws up near its mouth great quantities of amber. According to *Hartman*, amber is formed of a bitumen, mixed with vitriol and other salts. But though this were allowed him in regard to the fossil amber, many dispute whether the sea amber be so produced. The sea amber is usually finer to the eye than the fossil.

Dr. Girtanner in a late volume of the *Journal de Physique*, asserts it to be an animal product, a sort of honey or wax formed by a species of large ant, called by *Linnaeus*, *formica rufa*.

Amber of the finest kind has been found in England. It is frequently thrown on the shores of Yorkshire; and found even in our clay pits. The pits dug for tile-clay between Tyburn and Kensington gravel-pits, and that behind St. George's Hospital, in Hyde-park-corner, have afforded fine specimens.

Poland, Silesia, and Bohemia, are famous for the amber dug up there at this time. Germany affords great quantities, and also Sweden, Denmark, and the shores of the Baltic, but Prussia has it the most plentiful of all.

AMBERGRISE,

AMBERGRISE, or *Ambergrease*, or grey Amber, is a solid, opaque, ash-coloured, fatty, inflammable substance, variegated like marble, remarkably light, rugged and uneven in the surface, and has a fragrant odour when heated.

It is found swimming upon the sea, or the sea coast, or in the sand near the sea coast; especially in the Atlantic ocean, on the sea coast of Brazil and that of Madagascar, on the coast of Africa, of the East-Indies, China, Japan, and the Molucca Islands: but most of the ambergrise which is brought to England, comes from the Bahama Islands, from Providence, &c. It is also sometimes found in the abdomen of whales by the whale-fishermen, always in lumps of various sizes and shapes, weighing from half an ounce to an hundred and more pounds. An American fisherman, some years ago, found a piece of it in a whale, which weighed about 130 pounds, and sold for 500l. sterling.

There have been many different opinions concerning the origin of this substance. It has been supposed to be fossil bitumen, exuding out of the bowels of the earth, in a fluid form, and distilling into the sea, where it hardens and floats on the surface. But having been frequently found in the belly of whales, it has by others been considered as entirely an animal production. *Clusius* asserted it to be an indigestible part of the food, collected and found in the stomach of the whale. *Paul Dudley*, Esq. in the 23d vol. of the Philosophical Transactions, represents it to be a kind of animal product, like *musk*, secreted in a particular bag, or bladder, &c.

Kampfer seems to come nearer the truth when he says it is the dung of the whale; but the most satisfactory account of the real origin of ambergrease, is that given by Dr. *Swedjar*, in the 73d vol. of the Philosophical Transactions, who concludes with great probability, that it is generated in the bowels of the spermæeti-whale, and defines it to be the preternaturally hardened dung or fæces, mixed with some indigestible relics of its food.

The use of it is now nearly confined to perfumery, though it has formerly been recommended in medicine.

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In Asia and Africa, considerable use is made of it in cookery, by adding it to several dishes as a spice. Our perfumers add it to scented candles, balls, bottles, gloves and hair-powder, and its essence is mixed with pomatums for the face and hands, either alone, or mixed with musk.

Ambergrise may be known to be genuine by its fragrant scent, when a hot pin or needle is thrust through it and its melting like fat, of an uniform consistence; whereas the counterfeit will not yield such a smell, nor prove of such a fat texture. It is only valued for its purity, lightness, compactness, colour, and smell.

ALUM; a clear and transparent saline matter, usually sold in large masses, of a very austere, and astringent taste; useful in medicine and in various arts. Most of the alum to be met with is artificially prepared.

It is extremely useful in the art of dyeing; as by means of it a great number of colours are fixed; and rendered permanent upon cloth. It is also of use in the making of candles, for being mixed with the tallow, it gives an hardness and consistence, which it has not naturally. Wood sufficiently soaked in a solution of alum, does not easily take fire; and the same is true of paper impregnated with it; which for that reason is very properly employed in preserving gunpowder, as it also excludes the mixture of the air. It is also of use in tanning, where it assists in restoring the cohesion of the skins, almost entirely destroyed by the lime. Vintners fine down their wines, &c. with alum; fishers use it to dry cod-fish with.

In medicine it is of considerable use, as an astringent. In violent hemorrhages it may be given in doses of fifteen or twenty grains, and repeated every hour or oftener; but large doses are apt to nauseate the stomach.

Alum Mines are said to have been found in Italy in 1460. In 1608, the manufacture of alum was first invented, and successively practised in England.

TARTAR; a kind of salt which rises from wines, and sticking to the top and sides of the casks, forms a crust, which hardens to the consistence of a stone.

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Tartar, says an author, has the juice of the grape for its father, fermentation for its mother, and the cask for its matrix. The goodness of tartar rather depends on the number of fermentations, with succession of new wines in the same cask for several years, than on the soil or climate where the wine is produced.

It is either *white* or *red* according to the colour of the wine it is raised from. That brought from Germany is the best, as being taken out of those monstrous tuns, some of which hold a thousand pipes of wine; so that the salt has time to come to its consistence, which is one of the chief qualities to be regarded. That of Montpellier is the next in order: then that of Lyons, Paris, &c.

White tartar is preferred to *red* and is really better, as containing less of the drossy or earthy part. The marks of good tartar of either kind are its being thick, brittle, brilliant, and little earthy.

It is of considerable use among dyers, serving to dispose the stuffs to take their colours the better. The chymists make abundance of preparations from tartar; which is nothing but tartar powdered, and reduced by means of boiling water, a straining bag, &c. into little crystals.

Salt of Tartar, is tartar washed, ground, purified, and calcined, by a reverberatory fire; or it is made by pulverizing what remains in the retort after the distillation of tartar, and calcining it as above by a reverberatory fire, to make it yield a salt when put into hot water. On the one or the other of these preparations they pour hot water, to make a lye of it; this they filtrate, and evaporate the liquor by a sand heat, till the fixed salt be found at the bottom of the vessel. This is the *alkali*, or fixed salt of tartar.

Oil of tartar is the salt of tartar exposed to the air till it dissolve into an oil, though it is very improperly called an oil, being no more than a dissolved salt.

NITRE; a sulphurous, inflammable, bitter sort of salt, so called by the ancients; by the moderns more usually salt-petre. Naturalists differ indeed, whether our salt-petre be the nitre of the ancients: most authors supposed that

that the nitre was a mineral or fossil ; whereas our salt-petre is in a great measure artificial. There were nitre-pits in Egypt, as there are salt-pits among us.

All the *salt-petre* we now have, M. *Homburg* observes, is drawn either from earths moistened, and manured with the excrements of animals ; or from old walls and the plaister of ruined buildings, which have been filled with sulphurous matters, as well from the animals which inhabited them, as the soot penetrating them, and the air encompassing them. Salt-petre is either natural or factitious. The native salt-petre is either formed by a natural crystallization in caverns or old walls, or furnished by the waters of a dead lake in Egypt, called Nitrian waters. The first is called salt-petre of the rocks, the second is chiefly used in bleaching of linens.

Artificial salt-petre, is of two kinds also. One kind is procured in several places in the Kingdom of Pegu, &c. and in villages anciently populous, but now desert ; and about the banks of the Wolga in Russia. It is drawn from mineral earths, black yellow and white ; the black is the best, and needs no purifying after it come to us to fit it for making of gun-powder.

The method of working it is thus, two flat pits are dug, one of which they fill up of the mineral earths, turning water upon it for some time, and then tread it with their feet to the consistence of pap, letting it stand for two days for the water to imbibe all the salt. They then pass the water into another pit, where standing some time it shoots and crystallizes into salt-petre. This they boil once or twice, as they would have it more or less pure, scumming it continually, and filling it out into pots of twenty-five or thirty pounds each, and exposing these to the air in clear nights, by which means, if there be any impurity, it sinks to the bottom ; they then break the pots, and dry the salt in the sun.

The second kind of artificial salt-petre, is that prepared from nitrous matters collected in old buildings and ancient ruins, &c. by means of lyes made of wood-ashes. Of this, great quantities are made in France, particularly in the arsenal of Paris, where there is a corporation of salt-petre-makers.

Good common salt-petre should be cleansed, white, dry, and as free from common salt as possible. The best refined salt-petre is that whose crystals are the longest, largest and finest.

Philosophers generally allow the air to be impregnated with a volatile nitre, or salt-petre, which is thence communicated to plaister, mortar, &c. It is probable, it may derive it from soot and smoak, which are actually found to abound with a volatile salt of a nitrous quality. Dew and rain are supposed to fertilize the ground, principally by bringing down this nitre. Salt-petre has a property of rarifying or expanding itself to a prodigious degree. It is hence gun-powder derives its force, whereof salt-petre is the principal ingredient. It is computed that when inflamed, it takes up *ten thousand times* the space it possessed before.

There are abundance of chymical preparations made with salt-petre, as spirit of nitre, butter of nitre, &c.

VITRIOL is a mineral substance, whose basis is salt intermixed with something metalline. It is usually considered as a salt, but is more properly ranked among the class of semi-metals, as having a metallic matter, mixt or combined with salt.

They are white, blue, or green. Roman and Cyprus vitriol is *blue*; that of Sweden and Germany *greenish*; and there is also a *white* kind. The blue partakes of copper, the green of iron, and the white but little of any metal. *Geoffroy* says, they all consist of an acid salt, like that found in alum and sulphur; excepting, that in alum the acid is mixed with an absorbent earth or calx; in sulphur it is united with fatty, bituminous parts; and in vitriols with metallic parts.

The ancients gave the name of *calcitis*, or *calcanthum*, to native vitriol, or that which acquires its full perfection in the earth, and which is a kind of mineral stone. Some moderns take this calcitis to be the same with the *colcothar*, brought from Sweden and Germany, the best whereof is of a brownish red colour, and a vitriolic taste, and dissolves easily in water; and when broke is of the colour of shining copper.

The factitious vitriols are a kind of crystals, drawn by means of water, from a sort of marcasite ordinarily found in mines, and called pyrites. Roman vitriol is made by exposing these pyrites to the air till calcined, and then they are thrown into water ; afterwards, by boiling and evaporation, they are reduced into that kind of crystals sent us from Italy. All other vitriols are made after the same manner ; that is, much the same as alum is made in England, or salt-petre in France. For green vitriol, they add iron in the boiling. The powder of this vitriol is exceedingly styptic, and excellent for the cure of wounds, and the stopping of blood : and this is the basis of the famous sympathetic powder.

Some naturalists hold vitriol to be the root or matrix of copper ; because, in copper mines they never dig deeper than the glebe out of which the vitriol is drawn.

OPIUM ; a narcotic juice, commonly drawn from the head of the white poppy, and afterwards inspissated or thickened. When the juice flows of itself through incisions made in the poppy heads, it is properly called opium ; when drawn by expression, it assumes the name of meconium. The former is preferable, but rare ; the Turks, among whom it is produced, never allowing it to be exported. Opium comes mostly from the Levant and Cairo, but generally very impure. It must be chosen dry, the smoothest and blackest possible, of a drowsy smell, and neither rugged nor sticky, nor all in a mass. The juice, as it runs from the heads of the poppies, is of a milk colour, but becomes of a deep brown as it thickens.

Prepared opium is called *laudanum*. There are two kinds, the one simple, extracted by means of rain water and spirit of wine ; the other compound, containing several ingredients.

The uses of opium are to sooth pain, to excite sleep, to stop vomiting, &c. *Willis*, and others, look on it as a coagulating poison, which fixes the spirits in the nerves. *Pitcairn*, on the contrary, maintains it to be a hot dissolving poison, which reduces the blood to vapours.

PERUVIAN-BARK, *Cortex Peruvianus*, or Jesuit's bark, is the bark of a tree growing in the West-Indies. The Indians commonly call it the fuddling tree, from the property it has of intoxicating fishes, when either its food or bark is beaten, and steeped in the water where they are. The tree that yields this noble specific is chiefly found in Peru. It is above an hundred years since it was first known in England. When first introduced, it was sold for eight shillings the dose. It is now sold either in bark or in powder. Its chief use is in curing of agues, and intermitting fevers. It is applied in all ages, and on most constitutions. It is given several ways, either in powder, electuary, bolus, infusion, tincture, &c. Bark is found to have much surer and quicker effects when green than when dry, so that the Europeans only come in for the second rate virtues. The bad sort is also in great plenty; the good is very scarce.

It is said that a lake near a town in Peru, was surrounded by these trees, which were torn up by an earthquake and falling into the adjacent water rendered it bitter. An Indian, urged by his thirst, during a fever, drank of this water, and soon recovering, he related the case, and others were also cured. On enquiry, it was found that the quality was owing to the trees, and that the bark alone possessed the medicinal virtue. In 1640, a Spanish soldier was quartered in an Indian's house, and being seized with an ague, his landlord told him of a cure, and referred him to the bark. At length the vice-queen, wife of the Count de Cinchon, then vice-roy of Peru, was seized with an intermitting fever, the soldier cured her also. After this, Father de Lugo brought a parcel of it to Rome: from thence it spread into France and England, and now by way of eminence it is called The Bark.

TINCTURES. This word is more particularly used for an extract of part of the substance of a body, especially its virtue and colour which are hereby communicated. It is a separation of the finer and more volatile parts of a mixed body. We have various tinctures,
antiscorbutic

antiscorbutic tinctures, stomatic tinctures, anticholic tinctures, and tinctures drawn from roses, &c.

To make it, the matter is bruised, put in a matrafs, and the menstruum, which commonly is spirit of wine, poured on it. Then the glass is closed, and set for digestion, in a sand heat, during some days, till the spirit is well impregnated. Thus are tinctures of odoriferous vegetables, as cinnamon, drawn; and the same menstruum serves for metals and minerals.

The tinctures of metals, are not proper tinctures; they are only dissolutions. The alchymists give the name *grand mineral tincture* to the Philosopher's stone.

IPECACUANHA, is a little wreathed root, about the thickness of a moderate quill, brought from several parts of the West Indies, much used as an emetic, &c. There are four kinds, brown, black, grey and white; the grey is most esteemed in physic; though the brown is most used, because easier obtained. It is firm, difficult to break, of a sharp bitter taste and grows in Brazil. The grey comes from Peru, by way of Porto-bello.

TOBACCO. *Nicotiana*, a plant, first discovered in America by the Spaniards about 1560, and by them imported into Europe. The Americans had used it long before. It was sent into Spain from Tobacco, a province of Yucatan, where it was discovered; and hence its name. Sir *Walter Raleigh* first introduced it into England about 1585, and taught the English how to smoke it. Considerable quantities are now cultivated in the Levant, on the coasts of Greece, in Italy, and the island of Malta. Tobacco is sometimes used externally, for destroying disorders of the skin, cleansing old ulcers, &c. But the most common uses are as a sternutatory when taken by way of snuff, as a masticatory by chewing in the mouth, or as effluvia by smoking it, and when taken in moderation it is considered as not an unhealthy amusement; but is not introduced in the fashionable circles as formerly.

Before pipes were invented it was usually smoked in segars. Tobacco forms a very considerable article of commerce. It is made up into rolls, by the Americans,
by

by means of a tobacco wheel; with this machine they spin the leaves, after they are cured, into a twist of any size they think fit, it will keep in this state several years, and be continually improving, as it always grows milder.

As to the culture of tobacco, after it is risen to a convenient height, they transplant it as we do lettuce, only more distant, and it is kept weeded and watered till the leaves are ripe. The stalks are then cut and left to dry, after which they are made up in little bundles, and afterwards formed differently by the wheel as above described.

SNUFF; a preparation of tobacco, made by reducing it into a powder, fit to be taken in at the nose in order to purge or clear the head of pituita. Tobacco is ordinarily the basis of snuff; other matters being only added to give it a more agreeable scent. The kinds of snuff, and their several names are infinite, and new ones are daily invented, so that it would be difficult, not to say, impossible, to give a detail of them. We shall only say there are three grand sorts; the first granulated, the second an impalpable powder, and the third the bran or coarse part remaining, after sifting the second sort.

The many mischiefs attending the unnatural practice of taking much of this powder of tobacco at the nostrils, have been described by the writers in general on these subjects. In the *Acta Eruditorum*, a remarkable accident is related, of a polipus which was formed in the œsophagus (or gullet), and which killed the patient by starving him, from an inability of swallowing.

OIL, is a fatty, unctuous, inflammable matter drawn from several natural bodies. The word oil is sometimes applied to the juices which distil naturally from plants and trees; as balm, &c. but more strictly to those juices drawn by expression, from plants, fruits, grains, and seeds; as oil of olive, or nut oil. The kinds of oils their properties, and manners of expression are numerous.

Oil of olives is the most popular, and most universal of all others; being that chiefly used in medicine, in foods, and salads, and hence called *salad oil*: it is also
used.

used in the manufactures. It is drawn from olives by presses or mills made for the purpose. The fruit is gathered when at its utmost maturity in December and January; as it begins to redden; being put under the mill as soon as gathered it yields that oil so very sweet, and of so charming a colour, called *virgin oil*. But as the olives newly gathered yield but little oil, those who rather regard quantity than goodness, leave them on the ground for some time, before they press them. Neither the smell nor taste of this second oil is very agreeable; and there is a third kind still worse, which is the common oil, procured by throwing boiling water on the pressings, and re-pressing them more strongly. The consumption of olive oil is incredible; the southern parts of France, Provence, Languedoc, &c. as also Candia, and some parts of Italy yield vast quantities. Its use every body knows; it being reputed one of the most universally useful things in the whole world.

Oil of sweet almonds, cold drawn, or without fire is prepared various ways. Some peel the almonds before they pound them; others do not; but only bruise them; others beat them in a paste. In effect there are very many different ways of preparing oil. *Pomet* has given a method easier and less expensive than any of the rest. Pound in a mortar a quantity of sweet almonds, then pass them through a coarse sieve, lay them in a hair cloth, and put them under the press between two plates of copper, steel, or the like; press them gently, and when all the unctuous and fluid part is expressed, you will have a sweet oil without any sediments, which is scarce avoidable in any of the other manners.

Palm oil or *oil of senegal*, a thick, unctuous liquor, of a yellow colour, and violet smell; drawn from the fruit of a kind of palm tree growing in many parts of Africa, particularly in Senegal. The Africans use this oil as we do butter. In Europe it is esteemed a sovereign remedy against cold humours, and is said to give ease in the gout; it is sometimes counterfeited with wax, oil of olives, iris, and turmeric; but the trick may be discovered either by air or fire.

Train oil, is the oil procured from the blubber of whales by boiling.

Oil

Oil takes new names from the drugs mixed with it ; as *oil of roses*, which is that mixed with roses : *oil of jessamine*, that perfumed with jessamine.

Oil among the chymists is the second of the elements ; and otherwise called sulphur. Dr. *Stare*, in the *Philosophical Transactions*, gives us a scheme of oils. He distinguishes oil into vegetable, animal and mineral.

The *animal oils* are those of hartshorn, human-skull, hoofs, &c. The *mineral oils* are those of amber, Barbadoes-tar, to which some add bees-wax.

Having said much in this section of *Gums* and *resins*, it may be proper to inform the young reader that the true difference between the one and the other consists in this : *resins* are more sulphurous, and gums more aqueous (watery), so that resins will dissolve but in oil or spirits of wine ; and gums in water. M. *Tournefort* makes also an intermediate class which partakes of the nature of both, and which he calls gum-resins.

FISH.

It is not the design of this work to enter into a natural history of fish in general, but just to notice the more common kinds, the times of catching, and the places where they frequent. The principal fisheries for salmon herrings, mackerel, pilchards, &c. are along the coast of Scotland, England and Ireland : for cod on the banks of Newfoundland ; and for whales about Greenland and Spitzbergen. The situation of the British coasts is the most advantageous in the world for catching fish ; and the Scottish islands, particularly those of the north and west, lie most commodious for carrying on the fishing trade to perfection ; no country in Europe can pretend to equal Scotland in the abundance of the finest fish, with which its various bays, rivers, lakes and coasts are replenished. There is a Corporation entitled, The Royal British Fishery.

Salmon fishery. The chief in Europe are in England, Scotland, and Ireland, in the rivers, and sea coasts near the rivers mouths. The fishing usually begins
about

about the first of January and ends by the last of September. It is performed with nets. The fish are seen to croud in shoals, in search of fresh water. They also fish for them higher up the rivers sometimes with nets; sometimes with a kind of locks or wears made for the purpose, with iron grates therein, so disposed, that the fish, in going up the river open them with their heads; but are no sooner entered than the gate closes. Thus they are inclosed as in a reservoir, where they are easily taken. In some places they fish for salmon in the night-time, by the light of torches or kindled straw. The fishermen watch when the fish draws towards the light, of which he is a great lover, and then they strike him with a spear, or else take him with nets spread for that purpose.

The capture of salmon in the Tweed is prodigious, about July, Mr. *Pennant* says, that a boat load and sometimes near two are taken at one haul: but from fifty to one hundred is very frequent. The coopers in Berwick begin to salt them in pipes and other large vessels, and afterwards barrel them to send abroad.

Moss of the salmon taken before April, or the setting in of the warm weather is sent fresh to London.

In the other coasts of Scotland the salmon is cured in the same manner, and in the spring great quantities are sent to London.

COD-FISHERY. The chief places, are the Bay of Canada, the great and little bank near the coast of Newfoundland, the Island of St. Peter, &c. The vessels used herein are from an hundred to an hundred and fifty tons burden, and catch thirty or forty thousand fish a-piece. The most essential article in this fishery is, to have a master who knows how to open the fish, to cut off the heads, and to salt them; upon his ability in this, the success of the voyage depends. The commerce of this fish is one of the most secure and gainful that is known. The best fishing season is from the beginning of February to the end of April, at which time the cod, which during the winter had retired to the deepest part of the sea, return to the bank and grow very fat.

Those

Those caught from March to June keep well enough ; but those in July, August and September soon spoil.

The fishing is sometimes done in a month, or six weeks ; sometimes it holds six months. As lent draws on, if the fishermen have not completed their cargo, they strive to make homeward the first ; the market being then the best. Some will make a second voyage, before others have got loading for the first. Each fisher only takes one cod at a time ; and yet, an experienced man will take three or four hundred in a day. They salt the cod on board. This description respects the *green cod fishery*. In the fishing of *drycod*, vessels of all sizes are employed. As cod is only to be dried in the sun, the European vessels are obliged to put out in March or April, to have the benefit of the summer for drying. The principal fishery for dry cod is along the coasts of Placentia. The fish intended for this use, though of the same kind as the green cod, are much smaller, and hence fitter to keep. The method of fishing is much the same in both ; only this latter is more expensive, as it takes up more time and employs more hands ; and yet scarce half the salt is used in this as the other. When they have taken salt, they are laid in piles on the galleries of the scaffold ; when drained, they range them on hurdles, and are frequently turned to dry the better.

There are four kinds of commodities drawn from cod, viz. the tripes and tongues are salted at the same time with the fish ; the roes or eggs, which being salted and barrelled up, serve to cast into the sea to draw fish together ; and lastly the oil, which is used in dressing of leather.

In Scotland, they catch a small kind of cod, on the coasts of Buchan, and all along the Murray frith on both sides ; as also on the frith of Forth, Clyde, &c. which is much esteemed. They salt and dry them in the sun, upon rocks, and sometimes in the chimney.

HERRING-FISHERY.—Herrings seem to have been unknown to the ancients. They are chiefly found in the north sea. Though there are other fisheries, there are none so copious.

Our great stations for this fishery are off the Shetland and Western isles, and off the coasts of Norfolk, in which the Dutch also share.

There are *two seasons* for fishing herring; the first from June to the end of August; and the second in autumn, when the fogs become favourable for this kind of fishing. Sir *Walter Raleigh's* observations on this article, prove the private emolument and public benefit resulting from a well applied industry; and Mr. *Pennant* has given us recent information concerning it. During winter it is a most dangerous and fatiguing employ. The manner of fishing has nothing particular in it. The nets wherein the fish is drawn should have their meshes an inch square, that none of the lesser fry may be taken. The commerce of herring, both pickled and red, is very considerable.

The signs of the arrival of the herrings, are flocks of gulls, who catch up the fish while they skim on the surface; gannats also plunge and bring them up from considerable depths. Both these birds are closely attended to by the fishers.

Cod-fish haddocks and dog-fish follow the herrings in vast multitudes; these voracious fish keep on the outside of the columns, and may be a concurrent reason of driving the shoals into bays and creeks. East winds are very unfavourable to the fishery.

In a fine day, when the fish appear near the surface they exhibit an amazing brilliancy of colours; all the various hues that dart from the diamond, sapphire and emerald enrich their track; but, during night if they play on the surface, the sea appears on fire and luminous as the brightest phosphorus.

Herrings are cured either *white*, or *pickled*, or *red*: of the first those done by the Dutch are the most esteemed; but the British cured herrings are little inferior, if not equal; the Dutch method of salting and barrelling being now no longer a secret. Red herrings must lie twenty-four hours in the brine: when taken out, they are strung by the head on little wooden spits, and then hung in a chimney made for that purpose. They are afterwards barrellled up for keeping.

Herrings are in general exported to the West-Indies, to feed the negroes ; or to Ireland, for the Irish are not permitted to fish in those seas.

MACKEREL-FISHERY.—The mackerel is a salt-water fish, found chiefly on the French and English coasts, and also in large shoals in divers parts of the ocean. It is a summer fish of passage. The fishing is usually in the months of April, May, and June, and even in July, according to the place. They enter the English channel in April, and proceed up to the straits of Dover as the summer advances, so that by June they are on the coasts of Cornwall, Sussex, Normandy, Picardy, &c. where the fishery is most considerable. They are excellent food fresh. In Cornwall they are also pickled and put in barrels. The fish is taken either with a line or net ; the latter is more considerable, and is usually performed in the night time. The water wherein mackerel have been boiled, often yields a light after stirring a little.

STURGEON-FISHERY.—The sturgeon is a large sea-fish, which at its seasons runs up the rivers ; having a sharp pointed snout, flat belly, and bluish back. They are reckoned among the number of royal fishes. The greatest sturgeon-fishery is in the mouth of the Volga, on the Caspian sea, where the Muscovites employ a great number of hands, and catch them in a kind of inclosure, formed by huge flakes, representing the letter Z repeated several times. These fisheries are open on the side next the sea, and close on the other ; by which means, the fish ascending in its season up the river is embarrassed in these narrow angular retreats, and so is easily killed with a harping iron. Sturgeons, when fresh, eat deliciously : to preserve them, they are salted in large pieces and put up in kegs. But the chief object of this fishery is the roe or spawn ; which is a commodity as much used in Muscovy, as butter in England.

PILCHARD-FISHERY.—The pilchard is less than the herring, but bigger than the anchovy. It is a small salt-water fish, and a fish of passage. The chief fisheries

fisheries are along the coasts of Dalmatia ; and on the coast of Bretagne, from Bell-isle as far as Brest, and along the coasts of Cornwall and Devonshire. On the coasts of Dalmatia, they are so plentiful, it furnishes all Greece and part of Italy. The coasts of Bretagne employ yearly above three hundred sloops, and a great number of seamen. The fish caught on our coasts, though bigger, are not so much valued as those of France ; owing principally to their not being so thoroughly cured. The season is from June to September. They naturally follow the light, and will gather about a boat that bears a light in the night time, which contributes much to the facility of the fishery. It is said of this fish, they are least in size, most in number, and greatest for gain of any taken out of the sea. It not only employs a great number of men at sea, but men, women, and children by land, in salting, pressing, washing, &c. Dr. Borlase assured Mr. Pennant, that there were at one time inclosed in St. Ives's Bay, 7000 hogstheads, each hogsthead containing 35,000 fish, in all 245,000,000.

ANCHOVY is a little sea-fish, used by way of sauce or seasoning. *Scaliger* describes it as of the herring kind, about the length of a finger ; others make it a kind of pilchard ; but it is a species different from either. It is caught about the months of May, June, and July, on the coasts of Catalonia, Provence, &c. at which season they pass through the Straights of Gibraltar into the Mediterranean. The fishing is chiefly in the night time, when a light being placed on the stern, the anchovies flock round and are caught in the nets. When the fishing is over, they are pickled in barrels of about 25lb weight, or in earthen pots.

OYSTERS are taken at Colchester, Faversham, Isle of Wight, Medway, &c. and in all the creeks between Southampton and Chichester ; from whence they are carried to be sold in pits about Wevenhoe and other places. They are supposed to breed in the month of August. Mr. *Leuwenhoek*, on the fourth of August opened an oyster, and took out a prodigious number of minute oysters, all alive, and swimming nimbly about

in the liquor. He could discover the joining of the shells, and they perfectly resembled the large oysters, though so minute. He reckoned three or four thousand in one oyster.

CRAB.—To this genus belong the crabs properly so called, also cray-fish, shrimp, lobster, &c.

The common large crab-fish has its abode from twenty to forty fathom water. These animals herd together in distinct tribes, and have their separate haunts for breeding and feeding; and will not associate with their neighbours. This has been carefully tried by marking the shell of a crab, and carrying it two or three miles distant, and there leaving it among the same species: this crab has, after this, found its way home, and been caught in its old abode by the same fisherman. The crabs of this species are from the size of a chesnut to twelve pounds weight.

All species of crabs cast their shells, though at what season, or how frequently, is not exactly ascertained. Nothing in the history of the crab is so singular as its breaking off its own limbs, which it occasionally does; and the creature is able to do this in any position, but the most advantageous way of making the experiment is to lay it on its back; then, with a pair of pincers break the shell, and bruise the flesh of one of the outer joints of a small leg; the wound will bleed, and the creature shew signs of pain by moving it about; afterwards it holds it quite still, in a direct and natural position, without touching any part of its body, or other legs with it; then on a sudden, with a gentle crack, the wounded part of the leg drops off, at the internodium of the second joint from the body. If a hole be pierced in the great claws, or legs, and an iron put in to lacerate the muscle, the effect is the same, and this large limb is thrown off in the same manner, only with more violence. When the leg is off, a mucus overspreads the wound, and stops the bleeding; and a small leg is by degrees produced, which afterwards attains to the size of the former. Nature seems to have given this singular power to this creature for the preservation of its life, in the mutual quarrels with others of its own species.

cies. In these, one crab lays hold of the claws of another, and crushes it so that it would bleed to death, had it not the power of giving up the limb and healing the wound. *Phil. Transf.*

The fishing of *lobsters* is all along the British channel, the Frith of Edinburgh, on the coasts of Northumberland, and on the coast of Norway, from whence great quantities are brought to London.

CARP is held the queen of *fresh water* fish; and, except the eel, lives longest out of the water. Their natural place is a pond; in running waters, they rarely, if ever, breed. This fish was brought into England by *Leonard Maschal*, about 1514; and it is valuable for stocking ponds, because of its quick growth and great increase. The carp spawns three times a year: the female does not begin to breed till eight or nine years old. The usual growth of carp is two or three inches length in a year; but in ponds which receive the water of common sewers, they have been known to grow from five to eight inches in a year. To make them grow large and fat, the growth of grass under the water should be promoted. For this purpose, when the ponds are very low, the *sides* should be well raked, and hayseeds sown plentifully thereon; by autumn there will be a crop of grass, which, when the pond comes to be overflowed, will be a fine feeding place for them. Carp spawn in May, June, and July, according to the warmth of the season. The curious have three ponds for them. They continue to grow for a long time, and to a very considerable size and weight, and have been said to live to be one hundred years old.

TENCH; a fine fresh water fish. It takes more delight among weeds in ponds, than in clear rivers, and covets to feed in foul waters. His slime is said to be of a healing quality for wounded fish; upon which he is commonly called the *fishes physician*. The season for catching this fish is in June, July, and August, very early and late, or even at night in the still parts of rivers.

TROUT; a delicious fresh water fish, coming in and going out of season with the buck, and spawning in the cold months of October and November; whereas most of the other species spawn in the hot summer weather. There are several kinds of this fish, all valuable; but the best are the *red* and *yellow* trouts, and of these the female is preferred. They are known to be in season by their large backs, which may serve as a rule for other fish. All the winter they are sick, lean, and unwholesome. At the latter end of May they are in their prime.

The **PIKE** is reputed the tyrant of the fresh waters. He is considered as the longest lived of all the fishes: the larger he is found, the coarser the food. This fish never swims in shoals, but always single. He spawns in February and March. The best sort is in rivers; the worst in meres and ponds. This fish bites best about three in the afternoon, in clear water, from the middle of summer till the end of autumn; but in the winter, all day long.

PEARCH, or Perch; a fish not unlike an hog, and hooked backed. He is voracious, is seldom above two feet long. He spawns in February and March, and bites best when the spring is far spent. There are some other kinds of fish, as the *Dace* and *Dare*, bearing a near resemblance to each other. The *chub*, a fresh water fish, with a large head; an inactive, though strong fish. Its spawns in March. The *roach* is not a very delicate fish, and very silly. Those in the rivers are more valued than those in ponds, though the latter are much the larger. They spawn about the middle of May. The *flounder* is a flat sea or river fish; caught in April, May, June, and July; and may be found both in the swift stream, and in the still deep. The *gudgeon* is a small fish of a very delicious taste. It spawns three or four times in the summer season, and feeds in streams.

EEL.—This is a fresh water fish. The kinds are various, though by some reduced to seven; the silver eel; a greenish, called the grey eel; a blackish eel; and

and an eel with reddish fins. There is also a variety in the river Thames, called *grigs*, and about Oxford, by that of *grigs* and *gluts*. The young of the first kind, when it comes from the female, is no bigger than a needle. Eels hide themselves in winter in the mud, without stirring out for six months, and even in summer they take no delight to be abroad in the day; so that the most proper time to take them is in the night. They are very frequent in all our fresh water ponds, ditches, and rivers. Mr. *Pennant* says, it is the most universal fish: It lives a considerable time out of the water, and is so tenacious of life, that its parts will move a considerable time after they are cut in pieces. Common eels grow to a large size, sometimes weighing fifteen or twenty pounds; but that is extremely rare. Mr. *Dale*, indeed, in the *Philosophical Transactions*, and some others, bring instances of eels much exceeding that size; but Mr. *Pennant* suspects them to have been *congers*, since the enormous fish they describe have been all taken at the mouth of the Thames, or the Medway. The conger, or conger eel, grows to a vast size. Dr. *Borlase* informs us, that they are sometimes taken near Mount's Bay of 100lb weight; and Mr. *Pennant* assures us, he has heard of some taken near Scarborough that were ten feet and a half long, and eighteen inches in circumference in the thickest part. They differ from the common eel in many particulars. Innumerable quantities of what are supposed to be their fry, come up the Severn about the month of April, preceding the shads, which it is conjectured migrate into this river to feed on them. They are called *elvers*. They swarm during their season, and are taken in a kind of sieve made of hair-cloth, fixed to a long pole; the fishermen standing on the edge of the water during the tide, puts in his net as far as he can reach, and drawing it out again, takes multitudes at every sweep, and will take as many during one tide, as will fill a bushel. They are dressed and reckoned very delicate.

Congers are extremely voracious, preying on other fish, and on crabs, at the time they have lost their shell, and are in a soft state. These fish are an article of commerce in Cornwall; numbers are taken on that coast,
and

and exported to Spain and Portugal, particularly to Barcelona. They are chiefly caught by *butlers*, which are strong lines, three hundred feet long, with sixty hooks, each eight feet asunder. Sometimes such a number of these are tied together as will reach a mile.

TORTOISE.—Before we quit the aquatic animals we may just observe of that amphibious reptile, the sea-tortoise, or turtle, that it is found in the West-Indies and the South seas. There are many species, principally distinguished by the peculiarities of their feet. It has four legs and a tail, and the body is covered with so strong a shell, that several men may stand on it without doing it any injury. The tortoise digs round holes in the sand, in which it lays several membranaceous eggs. It grows to a very large size, some having been found weighing 480lb. Those who take them, watch them from their nests on shore, in moon-light nights; and before they reach the sea, turn them on their backs, and leave them till morning, for they are utterly unable to recover their former position; at other times they hunt them in boats with a spear, striking them with it through the shell; and as there is a cord fastened to the spear, they are taken much in the same manner as whales.

SEAL.—This *sea-calf* is the only quadruped that inhabits the Caspian sea: but they are there in such numbers, as to afford the means of subsistence to many people in that country, as well as Greenland. They crawl by means of their fore-feet upon the island, where the fishermen kill them with long clubs. When one is being killed, several others run to him to protect him, but in reality only to suffer the same fate. They are exceedingly tenacious of life, and endure many hard blows before they die: some will even live many days after having received many mortal wounds. When these animals are fat, they look like oil bags rather than animals. The greatest numbers of them are killed in spring and autumn. Many small vessels go from Astrakan to catch seals; and they make there a sort of soap, with their fat mixed with pot-ashes.

The

The skins of seals are particularly useful for trunk-makers.

WHALE.—This section may be properly closed with an account of the whale-fishery. Whales are chiefly caught in the North seas; the largest sort about Greenland or Spitsburgen. At the first discovery of this country, and at the beginning of this fishery they took nothing but the pure oil and the whalebone, and all the business was executed in the country; by which means a ship could bring home the product of many more whales than she can at present as it is now conducted. The fishery begins in May and continues all June and July; but whether the ships have good or bad success, they must come away, and get clear of the ice by the end of August; so that in the month of September at farthest they may be expected home; but a ship that meets with a fortunate and early fishery in May, may return in June or July.

Every ship is provided with six boats, and to each boat belong six men for rowing, and an harpooner. Two of these boats are kept constantly on the watch at some distance from the ship, and when a whale is perceived, they set out in pursuit of it, and as soon as either of them are come up the harpooner discharges his harpoon at him. As soon as the whale is stuck, the men set up one of their oars in the middle of the ship. On perceiving this, the watchmen alarm all the rest with the cry of *fall, fall*, and the other boats go immediately to the assistance of the first.

The whale finding himself wounded runs off with prodigious violence, sometimes horizontally, at others he descends perpendicularly. The rope which is fastened to the harpoon is about two hundred fathoms long. The velocity with which the whale draws it over the sides of the boat, is so great that it is whetted to prevent its taking fire. The fishermen find it necessary to let go the rope for a time, till the whale is spent, otherwise his violence would sink the boat. The whale soon however comes up, for it cannot stay long below water, and being now fatigued and wounded stays above, longer than usual. He is now stuck again with an harpoon,
and

and again descends, but with less force; when he comes up again he is generally incapable of descending, but suffers himself to be wounded and killed, with long lances, which the men are provided with. He is known to be near death when he spouts up the water deeply tinged with blood.

The whale being dispatched, the carcass begins to float, when the fins and tail are cut off, a rope is tied to him and drawn to the vessel. Three or four men now go down upon the whale, cut off the lard or fat; and then the whale-bone, which they cut off with a hatchet, from the upper jaw of the fish, and make it up in packets. The fat and bone thus procured, what remains of the whale they leave for the bears who are very fond of it. Nothing now remains but to sail homewards, where the fat is to be boiled, and melted down into *train oil*.

A considerable trade is also carried on in the South seas, as the whales in that quarter, though inferior in size to those in the Northern climes, are much more valuable, in producing the *spermaceti*, a very profitable branch of commerce. The largest sort are those about Spitsburg, some of them two hundred feet in length; those on the coasts of America are about ninety or a hundred; and those on the coasts of Guyenne, and the Mediterranean the smallest of all.

OF FOWLS.

Under this head, a few only, and those of the most common kind will be noticed: and first of the

SWAN.—No bird, perhaps, makes so inelegant a figure out of the water, or has the command of such beautiful attitudes on that element, as the swan. Almost every poet has taken notice of it; but none with that justness of description and in so picturesque a manner as our *Milton*.

————— The swan with arched neck
Between her white wings mantling, proudly rows
Her state with oary feet. *Par. Lost. Book vii.*

In

In former times it was served up at every great feast, when the elegance of the table was measured by the size and quantity of the good cheer. Swans were formerly held in such great esteem in England; that by an act of Edward IV, no one that possessed a freehold of less clear yearly value than five marks, was permitted to keep any. Though at present they are not so highly valued as a delicacy, yet great numbers are preserved for their beauty.

The swan is found wild in Russia and Siberia: those about the Southern part of the Caspian sea are very large, and much esteemed for the use of the table.—By the Mahometans the swan is held in high veneration.

It is a very strong bird and sometimes exceeding fierce, and has been known to throw down youths and trample them under feet, and even to break the leg of a man with the stroke of their wings. It is said to be very long lived, and frequently to arrive at the hundredth year. They lay eight eggs, and sit six weeks. They feed on both fish and herbage.

It was the popular opinion among the ancients that the swan foretold his end, and that he sung more sweetly at the approach of death, but it has little of probability. They have also ascribed to him the powers of melody; hence Virgil

Vare, tuum nomen

Cantantes sublime ferent ad sidera cygni.

Ecl. ix.

But when he lays aside figure and fiction, he gives him his real note:

Dant sonitum rauci per stagna loquacia cygni.—*En. lib. x.*

In hard winters wild swans visit our coasts, in large flocks, but do not breed in Great Britain.

The *swan-geese*, is sufficiently common in England, and readily mix with the common goose; the breed uniting as freely, and continuing to produce as certainly as if no such mixture had taken place.

The

The GOOSE, breeds commonly once a year, but will frequently have two hatches in a season if well kept. The time of sitting is about thirty days. It is said to be very long lived.

The *bean-geese* is two feet seven inches in length. This species arrives in Lincolnshire in autumn. They never breed in the fens but all disappear in May. They retreat to the sequestered wilds of the North of Europe. The *bernacles* appear in vast flocks during winter on the North West coasts of this kingdom; they are very shy and wild; but on being taken, grow in a few days as familiar as our tame geese. They quit our shores in February, and retire as far as Lapland, and Greenland, to breed. The *snow-geese* are very numerous about Hudson's Bay. They visit Severn river in May, and stay a fortnight; but go farther North to breed. There are many other kinds that migrate.

DUCK.—There are two sorts of ducks with us, the *wild* and the *tame*, of each there are different species.

The *mallard*, frequents the lakes of different counties, and feeds upon frogs and several sorts of insects. The wild ducks pair in the spring, build their nests among rushes near the water, and lay from ten to sixteen eggs. The female is a very artful bird, and does not always make the nest close to the water, but frequently at a good distance from it; in which case the duck will take the young in its beak or between its legs. At moulting time, when they cannot fly they are caught in great numbers. They abound particularly in Lincolnshire, the great magazine of wild fowl in the kingdom, where prodigious numbers are annually taken in decoys. There are various means used to catch wild ducks and geese, of which *one* seems worth mentioning. The person wishing to take these, wades into the water up to the chin, and having his head covered with calash, approaches the place where the ducks are; when they not regarding an object of this sort, suffer the man freely to mix with the flock; after which he has only to pull them by the legs into the water one after the other till he is satisfied; returning as unsuspected by the remainder as when he first came among them. This method

rhod is frequently put in practice on the river Ganges, using the earthen vessels of the Gentoos, instead of the calabashes; these vessels are what the Gentoos boil their rice in, and after once used they look upon them as defiled, and in course throw them into the river as useless. The ducks seeing these vessels float down the stream look upon them with disregard, and the duck takers find them on this account convenient for their purpose.

TEAL.—The *common teal* is of a small size, about fourteen inches in length, and is common to our markets. The flesh is accounted excellent. The Chinese teal, is a very singular and elegant species and kept in China and Japan for the sake of its beauty. Attempts have been made, though without success, to breed them in this country. The English in China give it the name of Mandarin duck. The redheaded *widgeon* frequents the fens in this country in the winter season.

PARTRIDGE.—This is so valuable a bird for the table, that sportsmen have invented many ways of taking it; all of which succeed from the natural folly and timidity of the animal. Partridges delight mostly in corn fields, especially while the corn grows, for under that cover they shelter and breed, and when the corn is cut down, they find wheat and subsistence among the stubble. They sometimes lodge in the dead grass, under the roots of trees, &c. Sometimes they resort to coppices and under woods. They are extremely easy to take in nets; and they are sometimes taken with birdlime.

The partridge seems to be a bird well known all over the world, as it is found in every country and in every climate; as well in the frozen regions about the pole, as the torrid tracks under the equator. It even seems to adapt itself to the nature of the climate where it resides.

In Greenland the partridge, which is brown in summer, takes another covering in winter suited to the season; it is then cloathed with a warm down beneath; and its outward plumage assumes the colour of the snow among which it seeks its food: thus it is doubly fitted

for the place; by the warmth and the colour of its plumage; the one to defend it from the cold, the other to prevent its being noticed by the enemy. The dog as every one knows, is trained to this exercise; he is taught to lie down at the word of command, he is brought into the field, and when the sportsman perceives the covey, he orders his dog to crouch, and this is considered by him as the signal for covering the birds with his net. A covey thus caught is sometimes fed in a place proper for their reception; but they can never be thoroughly tamed, like the rest of our domestic poultry.

The QUAIL is not above half the size of the partridge, but resembles it in shape; and is like all the poultry kind in its habits and nature. The quail is known to be a bird of passage; and yet if we consider its heavy manner of flying, and its scantiness of plumage, we shall be surprized how a bird so apparently ill qualified for migration, should take such extensive journies. At one season of the year they are fierce and cruel to each other, fighting most desperately.—Quail fighting was a favourite amusement among the Athenians. They abstained from the flesh of this bird, deeming it unwholesome, as supposing it fed upon the white hellebore; but they reared great numbers for the pleasure of seeing them fight; and staked great sums of money as we do with regard of cocks, upon the success of the combat. Fashion has however changed with regard to this bird; we take no pleasure in its courage but its flesh is considered as a very great delicacy.

COCK.—No animal in the world has greater courage than the common dunghill cock, when opposed to one of his own species; and in every part of the world where refinement and polished manners have not entirely taken place, cock-fighting is a principal diversion. With us it is declining every day; and it is hoped it will in time become only the past time of the lowest vulgar.

A cock in three or four years becomes weak and grows old.

A domestic hen will lay above two hundred eggs in the year, provided she be well fed, and supplied with water and liberty.

If

If the hen be left entirely to herself she will seldom lay above 20 eggs in the same nest, without attempting to hatch them; but in proportion as she lays her eggs they should be removed, and she will continue to lay, vainly hoping to increase the number; but in the wild state she seldom lays above fifteen eggs. When the hen begins to sit nothing can exceed her perseverance and patience; she continues for some days immovable, and when forced away by the importunities of hunger she quickly returns. While the hen sits she carefully turns her eggs, till at length, in about three weeks, the young brood begin to give signs of a desire to burst their confinement. When all are produced, she then leads them forth to provide for themselves. Her affection and her pride seem then to alter her very nature, and correct her imperfections. No longer voracious and cowardly, she abstains from all food that her young can swallow, and flies boldly at every creature, that she thinks is likely to do them mischief.

PHEASANT.—Next to the peacock, pheasants are the most beautiful birds; and though so beautiful to the eye, are not less delicate when served up to table. Their flesh is considered as the greatest dainty.

In the woods the hen pheasant lays eighteen or twenty eggs in a season, but in a domestic state seldom more than ten, and on every account the pheasant seems better left at large in the woods, than brought to captivity.

Pheasants were first brought into Europe from Colchis. They eat corn, and various insects. Young pheasants prey upon ants.

The pheasant is an extremely timorous bird, of a sullen disposition. Their haunts are usually well-grown coppices and woods. The times of their coming out are in the morning soon after sun-rise, at noon, and at sunset. The young ones will be seen following the female, just as a flock of chicken follow the hen.

The **HERON** builds in clifts over the sea; though sometimes in high trees. This bird was formerly much esteemed as a food; it is remarkably long lived, sometimes exceeding even sixty years. It is a great devourer

of fish, does more mischief to a pond than even an otter. It has been found that an heron, will eat fifty moderate sized dace and roaches in a day. And that in carp ponds, visited by this bird, one heron will eat up a thousand store carp in a year, and will hunt them so close as to let very few escape.

BITTERN, is the name of a bird of the heron kind. It builds on the ground, and lays five or six eggs, which are roundish and of a greenish white. When wounded and going to be taken, it strikes at the persons eye, and ought carefully to be guarded against.

The PEACOCK, is a genus belonging to the order of *gallinae*. The common peacock is a native of India, and is still found wild in Ceylon and Java. So beautiful a bird could not long be permitted to be a stranger in the more distant parts, for so early as the days of Solomon, there were imported in the Tarshish navies apes and peacocks. *Alian* relates that they were held in such high esteem in Greece, that a male and female were valued at Athens at one hundred drachmas or thirty-two pounds five shillings and ten pence. At Samos they were preserved about the temple as the bird sacred to the goddess Juno. *Alexander* found great numbers of wild ones in India, and was so struck with their beauty, as to appoint a severe punishment on any person that killed them. The peacock is so well known that it is scarcely necessary to say the head is covered with feathers which bend backwards; the feathers of the tail are very long and beautifully variegated with eyes of different colours.

WATERING PLACES.

Having in this second part treated on foods, &c. for use, enjoyment, or medicinal virtue, we may not improperly subjoin a short description of the public watering places, for the information of young persons;
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not only on account of their real utility, but because they are made the subject of frequent conversation.

BATH WATERS, are the warm chalybeate waters of Bath, in Somersetshire, which have been long used both internally and externally, and extolled for their medical efficacy in a great variety of disorders.

Dr. *Falconer* infers, from a variety of experiments, that Bath water contains the following ingredients, viz. saline bodies, as vitriolic acid, the existence of which, however, is very dubious, and it has also common salt in a small quantity; inflammable bodies in large quantity; metallic bodies, as iron, in the proportion of one thirty-seventh and a half of a grain in a pint of water, and lead, which he suspects to be an accidental impregnation; earthy bodies in large quantity; and aerial bodies, as common air, probably both in solution or mixture of diffusion, and mephitic air in large quantity.

As stimulants, these waters are indicated in cachectic disorders, obstructions of the viscera, œdematous swellings succeeding fevers, or fits of the gout; in paralytic disorders, arising from the bilious colic, fumes of metallic substances, or fits of the gout or rheumatism; and also in such paralytic complaints as occur in weak habits, and in consequence of low diet, damp situations, &c. These waters are also of special service in the apoplexy, lethargy, and other similar disorders. Their efficacy, as stimulants, is also very considerable in all disorders that depend on the inertia of the organs of digestion, and in restoring the stomach to such a tone as enables it to send the gout from the noble parts into the extremities.

The Bath waters, as astringents, are indicated in debility and laxity of the moving fibres, as the rickets; in weakness succeeding large evacuations either of blood, stool, or perspiration; in restraining evacuations by stool and by the urinary passages, as in the diarrhœa and diabetes, and also that disposition to perspiration which sometimes attends people of a lax and irritable habit.

The diuretic power of these waters renders them peculiarly

culiarly serviceable in dropfical disorders, many of which have been cured by them in their last stage; also in leprous, scrophulous, and scorbutic complaints; and in discharging gravelly concretions from the kidneys and bladder.

By their diaphoretic quality, they stop or moderate habitual laxities of the bowels, and relieve violent reashings: they are serviceable in the diabetes, partly by changing the tendency of the fluids from the urinary to the perspiratory secretions; and have been found an efficacious remedy in that kind of dropsy which arises from the check given to perspiration from sudden changes of climates: they are also of great service in cutaneous eruptions, occasioned by obstructed perspiration, and generally affecting the face; in that kind or stage of the rheumatism, which is not attended with any considerable degree of fever or inflammation; and in allaying the pain and carrying off the paroxysms of the gout.

Bath waters, by their antispasmodic quality, are of the greatest service in hysteric and hypocondriac complaints, arising from a weak stomach and digestion; in the hysteric colic and bilious vomiting; in the colic of Poitiers, commonly called the dry belly-ach; in icterical complaints, by relaxing the spasmodic constriction of the biliary ducts, and opening a passage for the bile, and promoting the discharge of gall-stones; and in removing those particular obstructions which occur at an early period of life, and in hysteric constitutions; they are also by their antispasmodic property, often peculiarly serviceable in the gout, when it attacks the stomach.

The efficacy of these waters in cutaneous eruptions, attendant on a scorbutic habit of body, may probably be owing, in some degree, to their antiseptic quality, correcting the putrid tendency of the humours of the body; and also in cachectic complaints, and many other cases of debility, which these waters relieve.

In some cases, however, Bath waters are hurtful; as in hectic fevers; in suppurations of the lungs; in all cases of inflammation; in hæmorrhages; in plethoric habits; in confirmed obstructions of the abdominal viscera;

cera; and in cases, where the solids are very tender and friable; and the fluids very thin and acrid, which sometimes take place in a high degree of the scurvy.

These waters are also used externally in a variety of disorders with good effect; either by bathing or pumping, as occasion may require, especially if used inwardly at the same time. The efficacy of bathing in paralytic cases, has been long and generally acknowledged; it has also been of great service by its stimulant quality in cachectic disorders, and in the jaundice; as antispasmodic, it has been very efficacious in the asthma, jaundice; nervous diseases, as the epilepsy, St. Vitus's dance, the hysteric and the hypochondriac disease, the nervous head-ach, spasmodic vomiting, nervous atrophy, muscular contractions, and paralytic contractions of the extremities; as diaphoretic, the Bath waters have been much celebrated in the common rheumatism, where the inflammatory disposition is very slight, and yet the pain and other symptoms grievous and of long duration; in every variety of the gout, and the complications of it with many other disorders; in the scurvy, provided that bathing be not used if the putrid disposition should be so strong as to form external ulcers; in the colic, and in the leprosy; as diuretics, Bath waters are useful in liver complaints; in cutaneous disorders; in the calculus; as expectorants, they have been also of service in gouty coughs, by promoting a beneficial discharge. The external use of these waters is improper in continued fevers, local inflammations, both internal and external, in hæmorrhages, and in diarrhœas, attended with fever, or an extreme degree of irritability, in obstructions of the viscera, and in cases of extreme weakness.

When the complaint is local, pumping is generally preferred to bathing: in this case, the water is hotter than that of the bath; the stream of water is generally directed to the limb or part affected, and sometimes to that part of the spine, where the nerves that supply the place affected issue forth. In this way the Bath waters are used with great success in the palsy, in reducing dislocations of the vertibræ, in relieving contractions
of

of the limbs, in discussing incipient white swellings, in nervous cases, in fits of the gout, and rheumatic complaints, and in the tinea capitis or scald-head. Pumping and bathing are often used at the same time: the mud and scum of these waters have been also applied with good effect, by way of poultice in hard swellings, weak joints, contractions of the limbs, scald heads, running ulcers, &c. and herbs are sometimes boiled with them in the Bath waters to a proper consistence for such purpose.

BRISTOL WATERS are obtained from springs, known by the name of the Hot Wells. These waters at their origin are warm, clean, pellucid, and sparkling: and if left to stand in a glass, cover its inside with small air-bubbles. They give no scent, and are soft and agreeable to the taste.

The Bristol waters are supposed by many to be a modern discovery, and their use but of late date, but this is a very erroneous opinion. *Dr. Venner*, more than a century ago, has written professedly of them, and given them their true character, and proper commendations in all the diseases in which they are at this time found effectual, the diabetes only excepted, in which their use has not been known so long. They were not indeed much frequented at that time, nor for some years afterwards; but that was merely from the want of the necessary accommodations at the place.—*Dr. Maplet*, in the year 1639, wrote largely of their virtues, particularly in disorders of the urinary bladder and kidneys, and adds great praises of their external efficacy in curing cancerous ulcers; but with all this praise they never came into an universal repute, till their character was established by *Dr. Mead*, and *Dr. Lane*.

These waters have been recommended in a variety of disorders; in consumptions and weakness of the lungs; in cases attended with hectic fever and heat, (in which, beside other properties, they differ from the Bath waters;) in uterine and other internal hæmorrhages; in old dia-
rheas

rhœas and dysenteries; in the diabetes, for which some have extolled them as a specific; and in other cases, where the secretions are too much increased, and the humours too thin; in the stone and gravel; in the strangury; in colliquative sweats; in scorbutic and similar cases; in colics; in the gout and rheumatism; in loss of appetite and indigestion; and in many other diseases.

BUXTON WATERS.—The waters of medicinal springs near Buxton in the Peak of Derbyshire, resemble those of Bristol. These waters are the hottest of any in England, except those of Bath.

The Buxton waters break out in several places thereabouts; what is called Buxton bath, takes in several warm springs.

These waters taken inwardly are esteemed good in bloody urine; in the bilious colic; in loss of appetite, and coldness of stomach; in inward bleedings; in contraction of the vessels and limbs, especially from age; in cramps and convulsions: in the dry asthma without a fever. Inwardly and outwardly they are said to be good in rheumatic and scorbutic complaints; in the gout; in inflammation of the liver and kidneys, and in consumptions of the lungs; also in old strains; in hard callous tumours; in withered and contracted limbs; in the itch, scabs, nodes, chalky swellings, ring-worms, and other similar complaints. As to the difference of age and sex in patients, there is little caution required in the drinking of them, except that they should be taken more sparingly by young people, between the ages of twenty three and thirty, if very full of blood and juices.

CHELTENHAM WATERS are some of the best and most noted purging chalybeate waters in England; the springs of which are at Cheltenham near Gloucester. The dose is from one pint to three or four: they operate with great ease. They are best taken a little warm: they create an appetite; are excellent

cellent in scorbutic complaints: and have been used with success in the gravel.

TUNBRIDGE WATERS are the most famous chalybeate waters in England. The wells are situated about five miles from the town of Tunbridge in Kent. This is a brisk, light water, has a ferruginous taste, and contains also a little sea-salt: exposed to the air, it soon loses its virtues; as it does also in a few days in bottles. It is sometimes usual to mix with the first glass of the water, taken in the morning, either a little common salt, or some other purging salt, in order to make it operate: with a foul stomach it is apt to cause a vomiting. The Tunbridge water is chiefly resorted to in June, July and August; and is recommended in all the disorders in which the celebrated Spa waters of Germany are serviceable: as it possesses the same virtues, though in a weaker degree.

MATLOCK WATERS are warm waters supplied by several springs at Matlock, in Derbyshire; in their nature resembling Bristol water, except that they are very slightly impregnated with iron, and in their virtues similar to those of Bristol and Buxton. The baths are recommended in rheumatic complaints, cutaneous disorders, and other cases where warm bathing is serviceable.

MALVERN WATERS issue from two noted springs at Malvern, in Worcestershire: they are light and pleasant chalybeates, and almost entirely free from an earthy matter; three quarts of the holy well water being evaporated left behind scarce the fourth part of a grain of sediment. These waters are recommended as excellent in diseases of the skin; in leprosies, scorbutic complaints, the king's evil, glandular obstructions, scald heads, old sores, cancers, &c. they are also of use in inflammations and other disorders of the eyes; in the gout and stone: in cachectic, bilious, and paralytic cases; and in old head-achs. These waters are used externally by washing the part several times in a day, and afterwards covering it with cloths dipped

dipped in the water, and kept constantly moist. Those who bathe are said to go usually into the water with their linen on, and to dress upon it wet, without any inconvenience. These waters, when first drank, are apt to occasion a nausea in some; they purge others briskly for several days; but they operate by urine in all. They should be drank freely for some days before they are used externally.

ISLINGTON WATER is a light chalybeate water, reckoned one of the best of the kind about London. The iron in this water is held in solution by means of fixed air; and when the air has escaped and precipitates, if the water be left to putrefy, the fixed iron disengaged by the putrefaction again dissolves the iron, and causes it to be suspended in the water: it then recovers its chalybeate taste, and property of tinging with galls, both which it has lost before.

This water is recommended in digestion and loss of appetite, in lowness of spirits, nervous, hysteric, and hypochondriacal complaints, and relaxed constitutions, and raises the spirits. It is good in obstructions of the liver, the kidneys, &c. It is also serviceable in diseases of the skin, in scorbutic complaints, in the gravel, and in paralytic disorders. It operates chiefly by urine, and may be drank to the quantity of several half pints, or even pints according to the constitution of the patient. This water deserves to be esteemed and frequented.

AIX LA CHAPELLE waters arise from several sources, which supply eight baths constructed in different parts of the town. In smell, they resemble the washing of a foul gun: their taste is saline, bitter, and urinous; their heat is upwards of one hundred of *Fahrenheit's* thermometer; their general operation is by stool and urine, and they also promote perspiration.

These waters are efficacious in diseases proceeding from indigestion, and foulness of the stomach and bowels, in rheumatisms, in the scurvy, scrophula, and diseases of the skin, in hysteric and hypochondriacal disorders, in nervous complaints and melancholy, in the stone and gravel, in paralytic complaints, &c. They ought
not

not to be used in hectic cases with heat and fever, in putrid disorders, or where the blood is dissolved, or the constitution much impaired.

There are others, of considerable efficacy, in England, Scotland, &c. which must be omitted in this account.



PART THIRD.

MANUFACTORIES.

WOOL; the hair, or covering of sheep; which washed, shorn, dressed, combed, spun, and woven, makes divers kinds of stuffs and cloths, &c. for apparel and furniture. While the wool remains in the state it was first shorn off the sheeps back, and not sorted into its different kinds, it is called *fleece*. Each fleece consists of divers qualities, and degrees of fineness. The finest grows on the pole of the sheep; the coarsest about the tail; the shortest on the head and on some parts of the belly; the longest on the flanks. Wool is either shorn, or pulled off the skin after the sheep are dead; this last sort is short and finer; if it be short it is used for *hats*, and not in the manufacture of cloths, unless mixed in fleeces. The French and English usually separate each fleece into three sorts, viz. 1st. *Mother wool*, which is that of the back and neck. 2d. The wool of the *tail* and *legs*. 3d. That of the *breast* and under the belly. The Spaniards call these three sorts, *prime, second, thirds*.

Among the Spaniards, one hundred and twenty five shearmen are employed to shear a flock of ten thousand sheep. When sheared, the first thing is to weigh the wool; they next divide it into three sorts, and fix the prices of each. It is observed that the sheep of Andalusia, which never travel, have coarse long hairy wool, but that the wandering sheep have short, silky, white wool. The fineness being promoted by travelling from clime to clime and living in the free air.

The *wools* most esteemed are the English, chiefly those about Leominster, Cotswold, and the Isle of Wight; the Spanish, principally those about Segovia; and the French, about Berry: which last are said to have this peculiar property, that they will knot or bind with any other sort; whereas the rest will only knot with their own kind.

Among the ancients, the *wools* of Attica, Megara, Laodicea, Apulia, and especially those of Tarentum, Parma, and Altino, were the most valued.—*Columella* set the two last even above that of Tarentum; and *Varro* assures us, the people there used to clothe their sheep with skins, to secure the wool from being damaged.

Tavernier affirms, that the wools in Asia are incomparably finer than those of Europe; and that there is no doubt, but that wool was the golden fleece sought for at Colchis.

The art of preparing and working wool, is attributed, by the ancients, to Minerva; who, accordingly, is made the genius and protectress thereof.

English Wool.—The wools of England have always been in the highest repute; and that more abroad than at home. Some we have, which, manufactured by our own clothiers, *Chamberlayne* observes, does, both for softness and fineness, vie with the choicest silks. *Spanish wools*, we know, bear a great price among us; but it is certain, much the greatest part of that, which, when manufactured, our clothiers, &c. call *Spanish cloth*, grows in England.—And, that the French can make no good cloth with their own wool, without, at least, one third of English wool mixed with it. It is allowed, the goodness of the Spanish wools is owing to a few English sheep sent over into Spain, as a present, by Henry II. of England; or, as others will have it, though we think mistakenly, by Edward IV. in 1565.

The fineness and plenty of our wools is owing, in some measure, to the sweet, short grass in many of our pastures and downs; though the advantage of our sheep feeding on this grass all the year, without being obliged to be shut up in folds during the winter, or to secure them

them from wolves at other times, contributes not a little thereto.

The *Scotch* and *Irish wools*, are commonly sold abroad for English ; and on the same footing : but foreigners, skilled in those matters, find they come far short of it in fineness ; though, in some markets, the Irish is even said to be preferred to the English.

Anciently, the principal commerce of the nation consisted in wool unmanufactured ; which foreigners, especially the French, Dutch, and Flemish bought of us. Inasmuch, that the customs of English wool exported in *Edward* the third's reign, amounted, at 50s. a pack, to 250000*l.* per annum.—An immense sum in those days.

This excessive custom on the export of unmanufactured wool, set our people to the making it into cloth themselves : in which they succeeded so well, that towards the close of the sixteenth century, under the reign of queen Elizabeth, the exportation of wool at all was absolutely prohibited ; and this, upon pain of having the right hand struck off.

From that time, England has been exceedingly jealous of her wool. To prompt their vigilance, the judges, &c. in parliament, are seated on wool-packs. Accordingly, scarce a parliament but has renewed, and reinforced the prohibition ; particularly, about the middle of the seventeenth century, the exporting of wool was made a capital crime.

WOOLLEN-MANUFACTORY includes the several sorts of commodities into which wool is wrought ; as *broad cloths*, *long* and *short kerseys*, *bays*, *surges*, *flannel*, *says*, *stuffs*, *frize*, *stockings*, *caps*, *rugs*, &c.

The woollen manufactory, which now makes the principal article in our foreign and domestic trade, being that which furnishes the cargoes of our vessels, that employs our people, &c. may be said to have had its rise in the fifteenth century.

Till that time, our wool was all sold in the fleece, to such of our neighbours as came to fetch it. Among our customers, however, the principal were the Flemings and Brabanters ; and particularly the merchants

of Gant and Louvain, who took off vast quantities to supply two manufactories that had flourished in those two cities from the tenth century ; and had furnished the greatest part of Europe, and even England itself, with all sorts of woollen cloths, &c. But the richness of the manufactories of Gant, and the incredible number of hands employed therein, having spirited up the inhabitants to revolt, divers times, against their sovereigns, on account of certain taxes which they refused to pay ; the seditious were at length punished and dispersed, and part of them took refuge in Holland, and the rest in Louvain.

These last, together with their art of manufacturing cloths, carried with them their spirit of sedition : and it was not long 'ere several of them, to avoid the punishment they had deserved for killing some of the magistrates, removed into England ; where they instructed our people how to work their own wools.

This establishment is referred to the year 1420 ; from which time no endeavours have been spared to keep our wools to ourselves.

With respect to the woollen-manufacture, *Anderson*, (in his *Hist. Com.*) remarks that some sort of woollen cloth must have ever been made in all civilized countries and that wherever the Romans planted colonies, they there introduced the weaving of cloth. *Cambden* in his *Britannia*, speaking of the antiquity and eminence of the city of Winchester, says, there the Roman Emperors seem to have had their imperial weaving-house for cloths both of woollen and linen, for most probably that necessary art was preserved in Britain after the Romans quitted it, though perhaps in a plainer kind, till the fourteenth century, when King *Edward III.* introduced the fine manufacture from the Netherlands.

The year 1614, produced the discovery of a new species of woollen manufacture in England. The States-general of the Netherlands having prohibited the importation of any English woollen cloth, that was dyed in the cloth ; the English clothiers ingeniously devised the method of making mixtures dyed in the wool, rather than lose all the profits of dying and dressing.

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This has ever since obtained the name of *medley cloth* : all woollen cloth before this time, being only of one single colour dyed in the cloth ; as black, blue, red, &c.

So jealous are we now become of our woollens, that, besides the precautions taken to use all our own wools ourselves, we have added that of selling them ourselves, and of carrying them to the places where they are required, not admitting strangers to come and buy any in England. And hence the establishment of those famous magazines in Holland, the Levant, and the North, where our woollens are repositied, to be vended by factors, or commissioners. The magazine in Holland has changed place divers times ; and it has been successively at Middleburgh, Delft, Rotterdam, and Dort.

The machine for twitching wool, invented by Mr. *Hughes*, of Coggeshall, in Essex, to whom the Society for the encouragement of Arts, Manufactures, and Commerce, have adjudged a premium for this useful invention, is recommended by several baize-makers of Essex. The intention of Mr. *Hughes* in contriving it, was to find out the reverse motion, which he appears to have done effectually.

As the word twitching, when applied to the preparing wool, appeared to be a local term, Mr. *Hughes* was desired to explain what was meant by it, and what word was made use of for the same operation in other parts of the country. In answer to this request, Mr. *Hughes* informed the Society, that the use of this machine, was for opening and preparing the wool for the carders and spinners, which was formerly done by men beating it with sticks called rods. But of late, he says, the method has been to use mills, called gigging mills, which, in Yorkshire are termed towing mills. These are worked by men turning them backward and forward till the wool be sufficiently opened for use. He adds, that the reverse motion, as shewn in his machine, was much wanted : and the benefit and advantages of it are well known and approved ; it having been at work now several years.

CLOTH, in commerce, in its general sense, includes all kinds of stuffs wove or manufactured on the loom, whether they be threads of wool, hemp, or flax.

Cloth is more peculiarly applied to a web, or tiffue, of woollen threads, interwoven ; whereof some, called the warp, are extended lengthwise, from one end of the piece to the other : the rest, called woof, disposed across the first, or breadthwise of the piece.

Cloths are woven on the loom, as well as linens, druggets, ferges, camblets, &c. They are of various qualities, fine, coarse, strong, &c. some are made of wool, and this of different colours : the wools being dyed and dressed, are either spun or wove : others are wrought white, destined to be dyed in scarlet, black, blue, green, yellow, &c. Their breadths and lengths are various, according to the places where they are manufactured.

The goodness of cloth consists in the wool's being fine and well dressed ; in its being spun equally ; always observing, however, that the thread of the warp be finer and better twisted than that of the woof ; in the cloth's being well wrought and beaten on the loom, so as to be every where equally close and compact ; in the wool's not being finer and better at one end of the piece than in the rest ; in the lists being sufficiently strong, and of the same length with the stuff ; and that they consist of good matter, as wool, ostrich feathers, or the hair of Danish dogs ; which last is the best ; in the cloth's being well cleared of the knots and other imperfections ; in its being first well scoured with good fuller's earth, then fulled with the best white soap, and washed out in clear water ; in the hair, or nap's being well drawn out with the teazle, or thistle, on the pole, without being too much opened ; in its being shorn close ; yet without laying the ground or thread bare ; in its being well dyed ; in its not being stretched, or pulled farther than is necessary to set it square, and bring it to its just length and breadth ; in its only being pressed cold ; hot-pressing being an utter enemy to cloth.

Manufacturing of white cloths for dying.—The best wools for the purpose are those of England and Spain ; especially those of Lincolnshire and Segovia.

To use them to the best advantage ; when taken out of the bales, they must be scoured, by putting them in a liquor somewhat more than luke-warm, composed of three parts of fair water, and one of urine. After the wool has continued long enough in the liquor to dissolve and loosen the grease, it is taken out, drained, and washed in a running water. It is known to be well scoured, when it feels dry to the touch, and has no smell but the natural smell of the sheep.

In this state it is hung out to dry in the shade ; the heat of the sun being apt to make it harsh and untractable. When dry, it is beat with rods on hurdles of wood, or on ropes, to clear out the dust and grosser filth ; the more it is thus beat and cleaned, the more soft it becomes, and the better it spins. After beating, it is well picked, to clear the rest of the filth, that had escaped the rods.

It is now in a state to be oiled, and carded on large iron cards, placed a-slope. The best oil for the purpose is oil of olives ; one fifth of which, at least, should be used for the wool destined for the woof, and a ninth for that of the warp.

It is now given out to the spinners ; who first card it on the knee, with small fine cards ; then spin it on the wheel ; observing to make the thread of the warp smaller, by one third, than that of the woof, and much closer twisted ; in order to this, the latter must be spun with the band, or string open, and the former with it crossed.

The thread thus spun, reeled, and made into skeins ; that destined for the woof is wound on spools, i. e. on little tubes, or pieces of paper, or rushes, so disposed, as that they may be easily put in the eye of the shuttle. That for the warp is wound on a kind of rockets, or large wooden bobbins, to dispose it for warping.

When warped, it is stiffened with size ; whereof, that made of shreds of parchment is the best : and when dry, is given to the weavers, who mount it on the loom.

The

The warp being on the loom, the weavers, who are two to each loom, one on each side, tread at the same time, alternately, on the same treddle : i. e. now on the right step, and now on the left, which raises and lowers the threads of the warp equally ; between which they throw, transversely, the shuttle from the one to the other. And each time that the shuttle is thrown, and so a thread of the woof inserted within the warp, they strike it conjointly with the same frame wherein is fastened the comb, or reed, between whose teeth the threads of the warp are passed : repeating the stroke as often as is necessary ; in some cloths no less than twelve or thirteen times, viz. six with the warp open, and seven shut.

The weavers having continued their work till the whole warp be filled with woof, the cloth is finished : It is taken off the loom by unrolling it from the beam whereon it had been rolled in proportion as it was wove ; and now given to be cleared of the knots, ends of threads, straws, and other filth ; which is done with little iron nippers.

In this condition it is carried to the fullery, to be scoured with urine, or a kind of potter's clay, well cleaned and steeped in water, put along with the cloth in the trough, wherein it is full'd.

The cloth being again cleared from the earth, or urine, by washing it in water, is returned to the former hands, to have the lesser filth, small straws, and almost imperceptible knots taken off as before : then it is returned to the fuller, to be beat and filled with hot water, wherein five or six pounds of soap have been dissolved. The soap most esteemed is the white, especially that of Genoa. After fulling an hour and a half, it is taken out to be smoothed, i. e. to be pulled by the lifts lengthwise, to take out the wrinkles and creases occasioned by the force of the mallets, or pestles falling on the cloth when in the troughs.

The smoothing is repeated every two hours, till the fulling be finished, and the cloth brought to its proper breadth ; after which, it is washed in clear water, to purge it of the soap, and given, all wet, to the carders, to raise the hair, or nap, on the right side, with the
thistle

thistle or weed ; wherewith they give it two rubs or courses, the first against the grain, the second with the grain.

The cloth being dried after this preparation, the shearman takes it, and gives it its first cut, or sheering. This done, the carders resume it, and after wetting it, give it as many more rubs or courses with the teazle, as the quality of the stuff requires ; always observing to begin against the hair, and to end with it ; and to begin with a smoother thistle, proceeding still to a sharper and sharper, as far as the sixth degree.

After this, the cloth being dried, is returned to the shearman, who sheers it a second time, and returns it to the carder ; who, wetting it, gives it as many courses as he thinks fit, dries it, and gives it back again to the shearman ; who, after shearing it the third and last time, returns it to the carders, who repeat their operation as before, till the hair, or nap, be well ranged on the surface of the cloth, from one end of the piece to the other.

The cloth thus wove, fulled, napped, and shorn, is sent to the dyer. When dyed, it is washed in fair water, and the shearman takes it again, wet as it is, lays the hair, or nap, with a brush on a table, and hangs it on the tenters ; where it is stretched both in length and breadth, enough to smooth it, set it square, and bring it to its proper dimensions, without straining it too much ; observing to brush it afresh, the way of the hair, while yet a little moist on the tenter.

When quite dry, the cloth is taken off from the tenter, and brushed again on the table, to finish the laying of the nap : it is then folded, and laid cold under a press, to make it perfectly smooth and even, and to give it a little gloss.

The gloss is given by laying a leaf of vellum, or cap-paper in each plait of the piece : and over the whole a square plank of wood ; on which, by means of a lever, the screw of a press is brought down, with the degree of force judged necessary, with regard to the quality of the cloth. There are none but scarlets, greens, blues, &c. which receive this last preparation, blacks needing it not.

Lastly,

Lastly, the cloth being taken out of the press, and the papers removed, it is in a condition for sale, or use.

For the manufacture of mixt cloths, or those wherein the wools are first dyed, then mixed, spun, and wove of the colours intended, the process, except in what relates to the colour, is mostly the same with that just spoken of.

The method of adjusting the mixture, is by first making a felt of the colours of the intended cloth, as a specimen: the wool of each colour is weighed, and when the specimen is to the manufacturer's mind, he mixes, for use, a quantity in the same proportion; estimating each grain of the specimen at twenty pounds weight of the same wool in the cloth to be made.

BAYS in commerce, is a kind of coarse, open woollen stuff, having a long knap; sometimes frized on one side, and sometimes not frized, according to the uses for which it is intended.

This stuff is without wale, being wrought on a loom with two treddles like flannel. The manufacture of bays is very considerable in England, particularly about Colchester; and in Flanders; about Lisle and Tournay, &c.

Formerly the French as well as the Italians were furnished with bays from England; but of late the French work-men have undertaken to counterfeit them and set up manufactories of their own, and that with success; especially at Nants, Montpellier, &c.

The export of bays is very considerable in Spain, Portugal, and Italy. Their chief use is for the religious, and for linings in the army; the looking-glass makers also use them behind their glasses, to preserve the tin or quick-silver; and the case-makers to line their cases.

The breadth of bays is commonly a yard and half, yard and three quarters, or two yards, by forty two or forty eight in length: those of a yard and three quarters are most proper for the Spanish trade.

WORSTED, or Woolsted, in matters of commerce and manufacture, is a kind of woollen thread; worsted is properly a thread spun of wool that has been combed; and

and which in the spinning is twisted harder than ordinary.

It is chiefly used either to be knit or wove into stockings, caps, gloves, and the like.

The name worsted is supposed to be borrowed from a town thus called in Norfolk, noted for fine spinning. They who write it woolsted, do it on a supposition of the word being formed from wool, the matter of this thread.

FLANEL, or Flannel; a kind of slight, loose, woollen stuff not crossed, but very warm; composed of a woof and warp, and wove on a loom, with two treddles, after the manner of bays.

SAGATHEE, in commerce a slight woollen stuff being a kind of serge or ratteen, sometimes mixed with a little silk. It is manufactured chiefly at Amiens.

STOCKINGS. Anciently the only stockings in use were made of cloth, or milled stuffs sewed together; but since the invention of knitting and weaving stockings of silk, wool, cotton, thread, the use of cloth stockings is laid aside. The modern stockings whether wove or knit, are a kind of plexus, formed of an infinite number of little knots, called stitches, loops, or meshes, intermingled one with another. *Knit stockings* are wrought with needles made of polished iron, or brass wire, which interweave the threads, and form the meshes the stocking consists of. This operation is called knitting. The invention whereof it is difficult to fix precisely; though it is commonly attributed to the Scots, because the first works of this kind came from thence. It is added that on this account, the company of stocking knitters established at Paris, in 1527, took for their patron St. Fiacre who is said to have been the son of a king of Scotland.

Woven-stockings are ordinarily very fine; they are manufactured on a frame or machine made of polished iron; the structure of it is exceedingly ingenious, but yet exceedingly complex. On this account it is very difficult

difficult to describe well ; nor is it even conceived, without much difficulty, when working before the face.

The English and French have contested the honour of the stocking frame. *Chambers*, relates that a Frenchman first invented this useful machine ; but finding some difficulties in carrying his plan into execution at Paris, he came over to England, where his machine was admired, and he rewarded according to his merit. The invention thus imparted to the English they became so jealous of it that for a long time it was forbid, under pain of death, to carry any of the machines out of the Island, or communicate a model thereof to foreigners ; a Frenchman however first carried it abroad ; and by an extraordinary effort of imagination, made a loom at Paris. Others more confidently assert that the inventor was an Englishman, of the name of Lee.

CALAMANCO ; a sort of woollen stuff, manufactured in England and Brabant. It has a fine gloss ; and is checkered in the warp, whence the checks appear only on the right side. Some calamancos are quite plain, others have broad stripes, some with narrow stripes, and others watered.

FLAX ; a plant with a slender hollow stem, usually about two feet high ; whose bark consists of fibres, or threads, much like those of hemp ; dressed and worked in due manner, and makes that noble commodity linen-cloth.

Flax thrives best in a soil that has long lain fallow. The best seed is that brought from the East ; which, though dear, repays the charges with abundance. One sowing will produce two or three crops, before it need be renewed. Flax pulled up in the bloom, proves whiter, and stronger than if left standing till the seed is ripe ; but then the seed is lost.

The preparations Flax must undergo, to fit it for spinning, are pulling, drying, and swinging.

The seed of Flax called Linseed, has several considerable properties. It enters the composition of divers medicines, and yields an oil by expression, which has most of the properties of nut oil ; and which is frequently used in defect thereof. In painting, to burn
in

in lamps, &c. That drawn cold, is reputed good in divers diseases.

HEMP is a plant of great use in the arts and manufactories, furnishing thread, cloth, and cordage. Hemp by naturalists called *cannabis*, bears a near analogy to flax ; both in respect of form, culture, and use.

The plant is annual ; that is, must be sown afresh every year ; its fruit or seed, is small and round filled with a white solid pulp ; and grows on the top of a stem ; having its pedicles distinct from those of the flowers ; its bark is a tissue of fibres joined together by a soft matter which easily rots it.

Hemp is of two kinds ; male, popularly called *karl* ; and female, or *simble*. It is the male alone that produceth seed, to perpetuate the kind ; from the seed of the male arises both male and female.

CAMBRIC, is a species of linen made of flax, very fine and white, the name of which was originally derived from the city of Cambry, where they were first manufactured. They are now made at other places in France.

The manufacture of cambrics, hath long since proved of extraordinary advantage to France. For many years it appeared that England did not, in this article, contribute less than 200,000*l.* per ann. to the interest of France. Many laws were therefore enacted to prevent this loss of our wealth. Any person convicted of wearing, selling, &c. French lawns are liable to a penalty of 5*l.* The cambrics we are allowed to wear, are manufactured in Scotland and Ireland.

CANVAS, is made of hemp or flax, wove regularly in kind of little squares, and used for working tapestry with the needle, by passing threads of gold, silver, silk, wool, &c. through the intervals or squares.

Canvas is also a coarse hemp cloth, used for ship-fails. Canvas is also used by painters, on which to draw their pictures. The canvas being smoothed over with a slick-stone, then sized over, and afterwards whited over. This makes what the painters call their

primed-cloth, on which they draw their first sketches, with coal or chalk, and afterwards finish with colours.

SILK, a very soft, fine, bright, delicate thread; the work of an insect, called *bombyx*, or the *silk-worm*.

The ancients were but little acquainted with the use and manufacture of silk: they took it for the work of a sort of spider, or beetle, who spun it out of its entrails, and wound it with its feet about the little branches of trees. This insect they called *ser*, from *Seres*, a people in Scythia, who kept it; whence the silk itself they called *sericum*. But the *ser* has very little affinity with our silk-worm, *bombyx*: the former living five years; but the latter dying annually, enveloped in a yellowish bag, or ball; which, wound out into little threads, makes what we call silk.

It was in the isle of Cos, that the art of manufacturing silk was first invented; and Pamphila, daughter of Platis, is honoured as the inventress. The discovery was not long unknown to the Romans. Silk was brought them from Serica, where the worm was a native. But so far were they from profiting by the discovery, that they could not be induced to believe so fine a thread should be the work of a worm; and thereupon formed a thousand chimerical conjectures of their own.

Silk was a very scarce commodity among them for many ages: it was even sold weight for weight with gold; insomuch, that Vopiscus tells us, the emperor Aurelian, refused the empress, his spouse, a suit of silk, which she solicited of him with much earnestness; merely on account of its dearness.—At length, two monks, coming from the Indies to Constantinople in 555, brought with them great quantities of silk-worms, with instructions for the hatching of their eggs, rearing and feeding the worms, drawing out the silk, spinning and working it. Upon this, manufactures were set up at Athens, Thebes and Corinth.

About the year 1120, Roger, king of Sicily, established a silk manufactory at Palermo, and another in Calabria; managed by workmen, who were part of the plunder

plunder brought from Athens, Corinth, &c. whereof that prince made a conquest in his expedition to the holy land.—By degrees, *Mezeray* adds, the rest of Italy and Spain learned from the Sicilians and Calabrians, the management of the silk-worms, and the working of silk : and at length the French, by right of neighbourhood, a little before the reign of Francis I. began to imitate them.

The great advantage the new manufacture turned to, made our King James I. very earnest for its being introduced into England: accordingly it was recommended several times from the throne, and in the most earnest terms, to plant mulberry-trees, &c. for the propagation of silk-worms; but, unhappily, without effect: though from the various experiments we meet withal in the Philosophical Transactions, and other places, it appears, that the silk-worm thrives and works as well, in all respects, in England, as in any other part of Europe.

The silk-worm is an insect, not more remarkable for the precious matter it furnishes for divers stuffs, than for the many forms it assumes, before and after its being enveloped in the rich ball it weaves itself. From a small egg about the size of a pin's-head, which is its first state, it becomes a pretty big worm, or maggot, of a whitish colour, inclining to yellow. In this state it feeds upon mulberry-leaves, till being come to maturity, it winds itself up into a filken bag, or case, about the size and shape of a pidgeon's egg; and becomes metamorphosed into an aurelia: in this state it remains without any signs of life, or motion: till at length it awakes, to become a butter-fly; after making itself a passage out of its filken sepulchre. And, at last, dying indeed, it prepares itself, by an egg, or seed it casts, for a new life; which the warmth of the summer-weather assists it in resuming.

As soon as the silk-worm is arrived at the size and strength necessary for beginning his ball; he makes his web: for it is thus they call that slight tissue, which is the beginning, and ground of this admirable work. This is his first day's employment. On the second, he forms his ball, and covers himself almost over with

filk. The third day, he is quite hid; and the following days employs himself in thickening and strengthening his ball: always working from one single end, which he never breaks by his own fault; and which is so fine, and so long, that those who have examined it attentively, think they speak within compass, when they affirm, that each ball contains silk enough to reach the length of six English miles.

In ten days time, the ball is in its perfection; and is now to be taken down from the branches of the mulberry-tree, where the worms have hung it. But this point requires a deal of attention: for there are some worms more lazy than others; and it is very dangerous waiting till they make themselves a passage, which usually happens about the fifteenth day of the month.

The first, finest and strongest balls, are kept for the grain; the rest are carefully wound: or, if it is desired to keep them all, or if there be more than can be well wound at once; they lay them for some time in an oven moderately hot, or else expose them, for several days successively, to the greatest heat of the sun, in order to kill the insect; which without this precaution, would not fail to open itself a way to go and use those new wings abroad, it has acquired within.

Ordinarily, they only wind the more perfect balls. These that are double, or too weak, or too coarse, are laid aside; not as altogether useless, but that, being improper for winding, they are reserved to be drawn out into skeins.

The balls are of different colours; the most common are yellow, orange-colour, isabella, and flesh-colour. There are some also of a sea-green; others of a sulphur-colour, and others white: but there is no necessity for separating the colours and shades to wind them apart; as all the colours are to be lost in the future scouring and preparing of the silk.

To wind the silk from off the balls. Two machines are necessary; the one a furnace, with its copper; the other a reel, or frame, to draw the silk. The winder, then, seated near the furnace, throws into the copper of water over the furnace (first heated and boiled to a certain

certain degree, which custom alone can teach) a handful or two of balls, which have been first well purged of all their loose furry substance. He then stirs the whole very briskly about with birchen rods, bound and cut like brushes; and when the heat and agitation have detached the ends of the silks of the pods, which are apt to catch on the rods, he draws them forth; and joining ten or twelve, or even fourteen of them together, he forms them into threads, according to the bigness required to the works they are destined for: eight ends sufficing for ribbands, and velvets, &c. requiring no less than fourteen. The ends thus joined into two or three threads, are first passed into the holes of three iron rods, in the fore-part of the reel, then upon the bobbins, or pullies, and at last are drawn out to the reel itself, and there fastened, each to an end of an arm or branch of the reel. Thus disposed, the workman, giving motion to the reel, by turning the handle, guides his threads; substitutes new ones, when any of them break, or any of the balls are wound out; strengthens them where necessary, by adding others; and takes away the balls wound out, or that having been pierced, are full of water.

In this manner, two workmen will spin and reel three pounds of silk in a day; which is a different dispatch than is made by the spinning-wheel, or distaff.—Indeed, all silks cannot be spun and reeled after this manner: either by reason the balls have been perforated by the silk-worms themselves, or because they are double, or too weak to bear the water; or because they are coarse, &c. Of all these together, they make a particular kind of silk called *floretta*: which being carded, or even spun on the distaff, or the wheel, in the condition it comes from the ball, makes a tolerable silk.

The several preparations which silks undergo, to fit them to be used in the manufacture of filken stuffs, are the spinning, reeling, milling, bleaching and dying. The two first we have already spoke of, as they are concerned in drawing the silk from off the balls. As to the spinning and reeling of raw silks off the balls, such as they are brought hither from Italy, the Levant,

&c. the first is chiefly performed on the spinning-wheel; and the latter, either on hand-reels, or on reels mounted on machines, which serve to reel several skeins at the same time. As to the milling, they use a mill composed of several pieces, which may mill two or three hundred bobbins at once, and make them into as many skeins.

Silk is distinguished by different names, according to its different states.—Thus,

Raw silk is that taken from the ball, without fire, and wound without any boiling: such as is most, if not all, that is brought into England from the Levant.

In the French silk-works, the greatest part of this raw silk passes for little better than a kind of fine floretta; yet, when spun, it makes a bright thread, and serves for the manufacture of stuffs of moderate value and lustre. But the raw silks of the Levant, whence most of ours come, are exceeding fine and beautiful.—This difference arises hence, that in France the best balls are spun and wound in boiling water; and only the refuse made into raw silk: whereas, in the Levant, there is no such thing as spinning or winding on the fire; but the silks are all sent in bales or packs, as they are drawn from off the balls: so that they are only distinguished by their quality of fine, middling, and coarse.

Boiled silk, is that which has been boiled in water, to facilitate the spinning and winding. This is the finest of all the sorts of silk manufactured in France, and is seldom used, but in the richest stuffs; as velvets, taffeties, damasks, brocades, &c.

There is also another kind of boiled silk, which is prepared by boiling, to be milled; and which cannot receive that preparation, without being first passed through hot water.

Thrown or twisted silks are such, as, beside their spinning and winding, have received their milling or throwing.

This they receive in a different degree, as they are passed oftener, or seldomer, over the mill: properly, however, thrown silks, are those wherein the threads are pretty thick thrown, and are twisted several times.

Slack

Slack silks are such as are not twisted, but are prepared, and dyed, for tapestry, and other works, with the needle.

Eastern or East-Indian silk.—That particularly thus called, is not the work of the silk-worms, but comes from a plant that produces it, in pods, much like those of the cotton-tree. The matter this pod contains is extremely white, fine, and moderately glossy: it spins easily, and is made into a kind of silk, that enters the manufacture of several Indian and Chinese stuffs.

French silks.—It is only in the most southern provinces of France, that silk is cultivated, mulberry-trees planted, and worms bred. The principal are those of Languedoc, Dauphine, Provence, Avignon, Savoy and Lyons. This last place, indeed furnishes very few silks of its own growth; but is the great staple whence the merchants of Paris and the other cities are to fetch them: at least, they are obliged to have them pass through Lyons, if they bring them from elsewhere, either by land or sea.

At the time when the manufactures of Lyons were in their prosperity, there were reckoned 18000 looms employed in the silk manufacture; but they are so fallen, that even in 1698, there were not reckoned 4000. The decay is not less notable at Tours; they had formerly 700 mills for winding and preparing the silks; 8000 looms to weave them, and 40,000 persons employed in the preparation and manufacturing thereof.

Sicilian silks.—The commerce of the silks of Sicily, is very considerable; and the Florentines, Genoese and Lucchese, are the people who chiefly make it.—Great quantities are yearly brought thence, especially from Messina; part whereof they use in their own manufactures, and sell the rest to their neighbours, the French, &c. with profit. The Italians have this advantage, especially the Genoese, over other people, that having large establishments in the island, they are reputed as natives, and pay no duty for the export.

Part of the Sicilian silks are raw; the rest spun and milled; of which last kind, those of St. Lucia and Messina, are the most valued. The raw, unwrought
silks

silks are always sold for ready money ; the others, sometimes, in exchange for other goods.

Italian Silks.—The silks brought from Italy are partly wrought, and partly raw and unwrought. Milan, Parma, Lucca, and Modena furnish none but the latter kind ; Genoa most of the former ; Boulogna affords both kinds.

Spanish Silks are all raw ; and are spun, milled, &c. in England, according to the several works they are to be used in.

Turkey Silks are all raw.—One advantage we have in the commerce of the Levant, in silks, wanting in those of Sicily, is, that the latter are confined to a particular season of the year ; whereas the former are bought at all times. They are brought from Aleppo, Tripoli, Sayda, from the isle of Cyprus, Candia, &c. But the principal place of commerce, especially the silks of Persia, is Smyrna. The silks are brought hither in caravans, from the month of January to September. The caravans in January, are loaden with the finest silks ; those of February and March bring indifferent ones ; the rest, the coarsest.

They all come from the several provinces of Persia, near the edge of the Caspian sea ; from which places, a Dutch author assures us, there do not come less than 30,000 bales of silk in a year. Ardeuil or Ardebil, a city of Persia, not far distant from these silk countries, is the place where the silks are laid up, and whence the caravans set out for Smyrna, Aleppo, and Constantinople ; and it this city, with Schamachia, that have always been esteemed the centre of the silk trade ; which has several times been attempted to be removed from Smyrna and the Mediterranean, in favour of Archangel and the white sea, by carrying them across Muscovy, by the Volga and Dwina.

In 1688, the commerce of Persian silks had like to have been removed from Smyrna by an earthquake, which almost overturned the whole city : and, doubtless, the removal had been effected, but for the vigorous means used by the Turks to prevent it. Smyrna, however, still remains in her ancient possession ; and the several nations of Europe continue every year to send their

their fleets, to fetch away the silks ; and matters are like to remain so, unless the conquests made by Peter the Great, along the Caspian sea, enable his successors, as it is certain he himself had such a thing in view, to put this great design in execution.

China, Japan, and Indian Silks.—Several provinces of China are so fertile in mulberry-trees, and their climate so agreeable to the nature of silk-worms, that the quantity of silk here produced is incredible : the single province of Tchekiam might supply all China, and even a great part of Europe, with this commodity. The silks of this province are most esteemed, though those of Nanquin and Canton be excellent.

The silk trade is the principal in China, and that which employs the most hands : but the European merchants, who deal in it, especially in wrought silks, are to be careful of the spinning, &c. the waste being usually very great, as the French East-India Company lately found to their cost.

Japan would not afford fewer silks than China ; but that the Japanese, a barbarous and distrustful people, have interdicted all commerce with strangers, especially with Europeans ; excepting with the Dutch ; who are said to be admitted on certain impious terms, related by *Tavernier*, but which we must own we cannot credit. Accordingly the Dutch have endeavoured to vindicate themselves by the pens of several famous writers.

The silks of the states of the great mogul, are brought almost wholly from Kasem-bazar, a mediterranean place, whence they are conveyed by a canal of fifteen leagues into the Ganges, by which, they are forwarded fifteen leagues further, to the mouth of the famous river of Indostan. The silk of Kasem-bazar is yellowish ; as are also those of Persia and Sicily ; there being none, that we know of, naturally white, but that of Palestine. The Indians, however, whiten it with a lye made of the ashes of a tree, called *Adam's fig-tree* ; but as the tree is pretty scarce, the Europeans are forced to take the greatest part of their silks in the native yellow. Kasem-bazar alone, is computed to furnish every year twenty-two thousand bales of silk, each bale weighing 100 pounds. Tho Dutch buy it almost all up ; not to bring

bring it into Europe, no more than they do that of Japan; but to exchange it for other rich merchandizes; particularly bars of silver, &c.

SPIDER SILK.—Within a few years the secret has been found in France, of procuring and preparing silk of the webs of spiders; and using it in several manufactures. This discovery is owing to *M. Bon*, who published a dissertation on the subject; whence what follows is extracted.

Spiders are usually distinguished, either with regard to their colour; as, into black, brown, yellow, white, &c. or with regard to the number, or arrangement of their eyes; some having six, others eight, others ten. But with regard to the silk-spider, *M. Eon* reduces them all to two kinds, those with long legs, and those with short; which last, are those which furnish the raw silk.

The silk-spider makes a silk, every whit as beautiful, glossy, and strong as the silk-worm: it spins it out of the anus, around which are five papillæ, or small nipples, and behind these, two others; all muscular, and furnished with spinsters. These nipples serve, as so many wire-drawing irons, to form and mould a viscous liquor, which, when dried in the air, after being drawn through them, makes the silk.

Each of these nipples, *M. Reaumur* observes, consists of a number of lesser and insensible ones; which one may be convinced of, by pressing a spider's belly between the fingers, to oblige the liquor to flow into the nipples; for by this means, applying the finger against the anus, several distinct threads will be drawn out through the perforations of the nipples. The threads are too fine to be told with any certainty: but *M. Reaumur* reckons, each larger nipple may send forth six or seven.

Hence we see how the spiders make their threads bigger, or smaller; for as, before they begin to spin, they always apply more or fewer of these six nipples, against the body whence the web is begun; or, as they apply each more or less strongly, so as more or fewer of the minuter nipples come to take; the thread thus spun,
will

will be a compound of more or fewer of the single threads. Indeed, as the threads come from the anus, all joined together, they appear to be single : but *M. Bon* has distinguished one of the single one to consist of fifteen or twenty distinct threads.

The threads are of two kinds ; the first is weak, and only serves for that kind of web wherewith they catch flies. The second is much stronger, and serves to wrap up their eggs in ; which, by this means, are sheltered from the cold, as well as from insects, which might otherways gnaw and spoil them. These threads they wind very loosely round the eggs, resembling the balls or bags of silk-worms, that have been prepared and loosened for the distaff.

The spider-bags are of a grey colour when new ; but turn blackish when long exposed to the air : indeed, one might find other spider-bags of other colours, and which would afford a better silk, but their scarcity would render the experiment difficult ; for which reason we confine ourselves to the bags of the commonest spiders, which are the short legged kind. These always find out some place secure from the wind and rain, to make their bags ; as, hollow trees, the corners of windows, or vaults, or under the eaves of houses.

By collecting a quantity of these bags, a new silk is made, inferior in nothing to the common silk. It takes all kinds of dyes, and may be made into all kinds of stuffs. *M. Bon* had stockings and gloves made of it, which he presented to the academy ; and others to the royal society.

For the manner of preparing the bags to get the silk, it is thus : After having gathered twelve or thirteen ounces of these bags, *M. Bon* had them well beaten for some time, with the hand, and a stick, to get out all the dust ; he then washed them ; in luke-warm water, till they left the water very clean : after this, he laid them to steep, in a large vessel, with soap and salt-petre, and gum-arabic. The whole was left to boil over a gentle fire, for three hours. The bags were next washed in warm waters, to get out the soap ; and, after all, laid to dry some days, to fit them for carding ; which was performed by common silk-carders, but with
cards

cards much finer than ordinary. By this means he had a silk, of a very particular ash-colour, which was easily spun, and the thread spun from it both stronger and finer than that of the common silk ; which shews, that all sorts of works may be made of it ; nor is there any reason to fear, but it will stand any trials of the loom, after having passed that of the stocking-weavers.

The only difficulty, now, is in procuring a sufficient quantity of spiders' bags to make any considerable work of it ; which *M. Bon* observes, would be no difficulty at all, had we but the art of breeding them as they do silk-worms. For they multiply much more ; every spider laying six or seven hundred eggs, whereas the silk-worms do not lay above one hundred ; yet are these last so tender, &c. that one half die without making any bags, or are hindered by some little accident, from making their bags ; whereas the spiders hatch of themselves, without any care, in the months of August and September, in fifteen or sixteen days after they are laid ; the old spiders that lay them, dying soon after. The young ones thus bred, live ten or twelve months without eating, and continue in their bags without growing, till the hot weather putting their viscid juices in motion, forces them to come forth, spin, and run about to seek food. Were a way, therefore, found of breeding young spiders in rooms, they would, doubtless, furnish a much greater quantity of bags than silk-worms do. For of seven or eight hundred young spiders, which *M. Bon* kept, scarce one died in a year ; whereas, of one hundred silk-worms, not forty lived to make their bags.

M. Bon having ordered all the short legged spiders that could be found in the months of August and September, to be brought to him, shut them up in paper coffins and pots ; covering the pots with papers, which he pricked full of pin-holes, as well as the coffins, to give them air. He fed them with flies, and found sometime afterwards the greatest part of them had made their bags. The same excellent person found, that with regard to their weight, afford much more silk than those of the silk-worms ; as a proof hereof, he observes, that thirteen ounces yield near four ounces
of

of clear silk, two ounces whereof, will make a pair of stockings; whereas stockings of common silk weigh seven or eight ounces.

Nor is there any venom in the silk, or even in the spider, as many have imagined. *M. Bon* has been bit by them several times, without any manner of harm; and as for the silk, it is used with very good success, to stop bleeding and cure wounds, the natural gluten thereof acting as a kind of balsam. It likewise yields, by distillation, several specific medicines, particularly great quantities of spirit, and volatile salt, which being prepared after the same manner as that drawn from the bags of silk-worms, in making the *guttæ Anglicanæ*, or English drops, so famous over all Europe; may serve to make other drops of greater efficacy, which *M. Bon* calls, *drops of Montpellier*, to be used in all sleepy diseases.

M. Reaumur being appointed by the Royal Academy, to make a further enquiry into this new silk-work, raised several objections and difficulties against it; which are found in the memoirs of the academy.

SATIN, is a kind of *filken stuff*, very smooth and shining, the warp whereof is very fine and stands out, the woof coarser and hid underneath; on which depends its gloss and beauty which gives it its price.—Some satins are quite plain, others wrought, some flowered with gold or silk, others striped. The finest satins are those of Florence and Genoa, yet the French will not allow those of Lyons any thing inferior thereto.

Indian satins, or satins of China, are filken stuffs, much like those manufactured in Europe. Of these some are plain, others worked, either with gold, or silk, flowered, damasked, striped, &c. They are mostly valued because of their bleaching easily, without losing any thing of their lustre. In other respects they are inferior to those of Europe.

VELVET; a rich kind of stuff or *silk*; the nap, or velveting, of this stuff is formed of part of the threads of the warp, which the workman puts on a long narrow channelled ruler, and which he afterwards cuts by
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drawing a sharp steel tool along the channel of the ruler, to the end of the warp.

The principal and best manufactories of velvet are in France; there are others in Italy, as at Venice, Milan, Florence, Genoa, and Lucca, and in Holland, at Haerlem, those in China are the worst of all.

COTTON; a soft downy substance, found on the gossypium or cotton-tree. There are four species, all of them natives of warm climates. These plants are cultivated in great quantities in the fields for the sake of the cotton they produce but the species called herbaceous, is generally cultivated. The pods are sometimes as large as middling sized apples, closely filled with the cotton surrounding the seed. When these plants are raised in this country, they must be continually kept in a warm stove, where they will produce seeds and cotton. They are propagated by seeds.

The cotton tree grows in several places of the Levant, and of the East and West-Indies.

Cotton makes a very considerable article of commerce, it is distinguished into *cotton in the wool* and *spun cotton*. The first is ordinarily brought from Cyprus, Smyrna, &c. and the most esteemed is white, long, and soft. Of cotton thread, or spun cottons, that of Damas called *cotton d'ounce*, and that of Jerusalem called *bazas* are the most esteemed. *Cotton of Siam* is a kind of silky cotton in the Antilles, so called because the grain was brought from Siam. It is of an extraordinary fineness, even surpassing silk in softness: they make hose of it there preferable to silk ones, for their lustre and beauty. They sell from ten to twelve and fifteen crowns a pair, but there are very few made unless for curiosity.

Cotton anciently grew only in Egypt, and was used by the priests, and sacrificers for a singular kind of gowns, wore by them alone.

Spun cotton furnishes various cloths, muslins, calicoes, dimities and hangings; and it is frequently joined with silk and flax in the compositions of other stuffs.

TAPESTRY is a curious kind of manufacture serving to adorn a chamber, or other apartment, by hanging or lining the walls thereof.

Some use tapestry, as a general name for all kinds of hangings whether woven, or wrought with the needle; and whether silken, woollen, linen, leathern, or of paper: in which they are countenanced by the etymology of the word formed from the French *tapiffer*, to line, of the Latin *tapes* a cover of a bed, but in the common use of our language, the term is now appropriated to a kind of woven hangings, of wool and silk frequently raised and enriched with gold and silver, representing figures of men, animals, land skips, &c.

The invention of tapestry seems to have come from the Levant; and what makes this the more probable, is, that formerly, the workmen concerned therein were called; at least in France, Sarazins, or Saraziniois.

It is supposed that the English and Flemish, who were the first that excelled therein, might bring the art with them from some of the croisades or expeditions against the Sarazens.

Be this as it will, it is certain those two nations particularly the English, were the first who set on foot this noble and rich manufacture in Europe; now one of the finest ornaments of palaces, basilicæ, churches, &c.

Hence, if they be not allowed the inventors, they have, at least the glory of being the restorers, of so curious and admirable an art, as gives a kind of life to wools and silks in no respect inferior to the paintings of the best masters.

It was late before the French applied themselves to tapestry: the first establishment of that kind was under *Henry IV*; in the year 1607, in the Fauxbourg *S. Michael*. But this fell with the death of that Prince. Under *Louis XIV*, the manufacture was retrieved by the care and address of the great *M. Colbert*, to whom the establishment of the Gobelins is owing, a Royal Tapestry manufacture which has produced works in this kind scarce, inferior to the finest English or Flemish tapestry either with regard to the design, the colours, or the strength.

The tapestry-men distinguish two kinds of work, viz. Tapestry of the *high* and *low* warp, though the difference is rather in the manner of working than in the work itself, which is, in effect, the same in both, only the looms, and consequently the warps are differently situate; those of the low warp being placed flat, and parallel to the horizon and those on the contrary of the high warp erected perpendicularly.

The English anciently excelled all the world in their tapestry of the high warp; their low warps are still admired, but the high ones are quite laid aside in our nation. The French had three considerable tapestry manufactories besides that of the gobelins, viz. at Auvergne, Felletin, and Beauvois. The *low warps* in Flanders have been said to exceed those of France. The chief, are at Brussels and Antwerp, where they have succeeded both in human figures, in animals and landscapes, and that both in the designing and the workmanship.

It would be difficult and tedious to give a clear idea of the loom, or of the manufactory of tapestry; it may be observed however that it is all wrought on the *wrong side*; so that the workmen cannot see the right side of his tapestry till the piece be finished and taken off the loom.

The **GOBELINS**, is a celebrated manufactory, that was established at Paris; for the making of tapestry, and other furniture. The house where this manufacture has long been carried on was built by two brothers, Giles and John *Gobelins*, both excellent dyers, and the first who brought to Paris the secret of dying that beautiful scarlet colour, still known by their name. In 1667, this place changed its name from *Gobelins*, to *Hotel Royal de Gobelins*, by an edict of Louis XIV.

TAFFETY; a kind of fine, smooth silken stuff, having usually a remarkable gloss. There are taffeties of all colours, some plain others striped with gold, silver, silk, &c. others chequered or flowered. There are three things that contribute to the perfection of taffeties, the silk, the water, and the fire. The silk is not only

to be of the finest kind, but it must be worked a long time and very much before it be used. The *watering*, seems only intended to give it that fine lustre, by a peculiar property not found in all waters, and lastly, the perfection of the stuff, greatly depends on the particular application of the fire.

Ottavio May, of Lyons, is held the first author of the manufacture of glossy taffeties, and tradition tells us the occasion of it. *Ottavio*, it seems going backward in the world, and not able to retrieve himself by the manufacture of taffeties, such as were then made, was one day musing on his misfortunes, and in musing, chanced to chew a few hairs of silk which he had in his mouth. His reverie being over, the silk he spit out, seemed to shine, and on that account engaged his attention. He was soon led to reflect on the reason, and after a good deal of thought concluded that the lustre of the silk must come, first from his having pressed it between his teeth, secondly, from his having wet it with his saliva, which had something glutinous in it, and thirdly, from its having been heated by the natural warmth of his mouth. All this he executed upon the next taffeties he made, and hence soon acquired immense riches to himself, and to the city of Lyons the reputation it has long maintained of giving a gloss to taffeties, better than any other city in the world.

GAUZE or *Gawze*, a transparent kind of stuff wove sometimes of silk, and at other times only of thread. There are figured gauzes, some with flowers of gold and silver, on a silk ground; these last are chiefly brought from China. The gauze loom is much like that of the common weavers, though it has several appendages peculiar to itself.

CAMBLET is a stuff made of hair, silk or wool. In some the *woof* is hair; the warp is silk and wool twisted together.

Camblets are manufactured in Holland and Flanders and in France and England. Brussels exceeds them all in the beauty and quality of its camblets: those of England are next in repute.

The true or oriental camblet is made of the pure *hair* of a sort of *goat*, frequent about Angora, and which makes the riches of that city. All the inhabitants are employed in the manufacture and commerce of camblets. Middle-age writers mention stuffs made of *camel's-hair* under the denomination of *cameletum* and *camelinum* whence it was supposed the term was given; but these are strangely coarse, rough and prickly, and seem to have been used among the monks by way of mortification, as the hair shirts of later times.

We have no camblets made in Europe of the *goats hair* alone; even at Brussels they find it necessary to add a mixture of woollen thread.

Figured Camblets are those of one colour, whereon are stamped various figures, flowers, foliage, &c. by means of hot irons, which are a kind of moulds passed together with the stuff under the press; these are chiefly brought from Amiens and Flanders. The commerce of these was anciently much more considerable than at present. *Water camblets*, after weaving, receive a certain preparation with water, and afterwards pass under a hot press, which gives them a smoothness and lustre; *waved camblets* are those whereon waves are impressed, as on tabbies; by means of a cylinder, under which they are passed several times.

BROCADE, in commerce a sort of stuff or cloth of gold, silver, or silk, raised and enriched with flowers, foliages or other figures, according to the fancy of the manufacturer.

Formerly, the term was restrained from cloths wove either wholly of gold, both woof and warp, or of silver, or of both together; but by degrees it came likewise to pass; for such as had silk intermixed, to fill up, and terminate the flowers of gold and silver.

At present any stuff of silk, satin or even simple tapestry, when wrought and enriched with flowers, &c. obtains the denomination of brocade.

MOHAIR; a kind of stuff, ordinarily of silk both woof and warp; having its grain wove very close.

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There are two kinds of mohairs, the one smooth and plain ; the other watered like tabbies. The difference between the two only consists in this, that the latter is calendered, the other not. There are also mohairs, both plain and watered, whose woof is woollen, cotton, or thread.

TABBY ; in commerce, a kind of coarse taffety, watered. It is manufactured like the common taffety, excepting, that it is stronger and thicker both in the woof and warp.

The watering is given it by means of a calender ; the rolls whereof are of iron, or copper variously engraved, which bearing unequally on the stuff, render the surface thereof unequal, so as to reflect the rays of light differently.

It is usual to tabby mohairs, ribbands, &c. Tabbying is performed without the addition of any water, or dye, and furnishes the modern philosophers with a strong proof that colours are only appearances.

MUSLIN ; a fine sort of cloth, wholly cotton ; so called as not being bare, but having a downy nap on its surface, resembling moss, which the French call *mousse*. There are various kinds of muslins brought from the East-Indies, and chiefly from Bengal.

LACE ; a work composed of many threads of gold, silver, or silk, interwoven the one with the other, and worked upon a pillow with spindles, according to any pattern designed. The open work is formed with pins, which are placed and displaced, as the spindles are moved. The importation of gold and silver lace is prohibited.

Lace, bone, is a lace made of fine linen thread, or silk, much in the same manner as that of gold and silver. The pattern of the lace is fixed upon a large round pillow, and pins being stuck into the holes or openings, in the pattern, the threads are interwoven by means of a number of bobbins made of bone or ivory, each of which contains a small quantity of fine thread, in such a manner as to make the lace exactly resemble
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the pattern. There are several towns in England, and particularly in Buckinghamshire, that carry on this manufacture ; but vast quantities of the finest laces have been imported from Flanders.

CALICO, in commerce, a sort of cloth, resembling linens, made of cotton. The name is taken from that of Callicut, a city on the coast of Malabar, being the first place at which the Portuguese landed, when they discovered the India trade. The Spaniards still call it *callicu*.

Calicoes are plain, printed, dyed, stained, painted, chints, muslins, and the like, all included under the general denomination of *calicoes*. Some of them are painted with various flowers of different colours ; others are not stained, but have a stripe of gold and silver quite through the piece, and at each end is fixed a tiffue of gold, silver, and silk, intermixed with flowers. The printing of calicoes was first set on foot in London, about the year 1676.

FUSTIAN is a kind of cotton stuff, which seems as it were crossed on one side. Right fustians should be made altogether of cotton thread, both woof and warp. There are fustians of divers kinds and qualities, both with nap and without it. There are also many, whereof the warp is flax, or even hemp.

SKINS.

The word *skin* is particularly used for this membrane taken off an animal, to be prepared by the tanner, skinner, currier, parchment-maker, &c. and converted into leather.

TANNING ; the preparing of skins or hides in a pit, with tan and water, after having first taken off the hair, by steeping them in lime-water.

Method.

Method of tanning cows, calves, and horse-hides.—The skin being flaid off the carcass, if it be intended to be kept, it is salted with sea salt and allum, or with a kind of salt-petre, called natron; if it be not for keeping, the salting is saved, as being of no use, but to prevent the hide from corrupting before it can be conveniently carried to the tan-house.

Whether the hide have been salted or not, the tanner begins with taking off the horns, the ears, and the tail; after which it is thrown into a running water for above thirty hours, to wash off the blood, and other impurities adhering to the inside.

This done, it is laid over night in a lime-pit, already used; whence it is taken, and left to drain three or four days on the edge of the pit.

This first and slightest preparation over, it is returned into a strong lime-pit for two days, then taken out for four more; and thus for six weeks alternately, taken out and put in, twice a week.

At the six weeks ends, it is put into a fresh pit, where it continues eight days, and is taken out for so many; and this alternately for a year or eighteen months, according to the strength of the leather, or the weather; for in great heats, they put in fresh lime twice a week; and in frost they sometimes do not touch them for three months. Every fresh lime-pit they throw them into, is stronger and stronger.

At four, five, or six weeks end, the tanner scrapes off the hair on a wooden leg, or horse, with a kind of knife for that purpose. And after a year or eighteen months, when the hair is perfectly gone, he carries it to a river to wash, pares off the flesh on the legs with a cutting-knife, and rubs it briskly with a kind of whet-stone, to take off any remains of flesh or filth on the side of the hair.

The skin is now put into tan; that is, covered over with tan, as it is stretched in the pit, and water let in upon it: if the skin be strong, five coverings of tan will be required; for weaker, three or four may suffice. When the skin has not been kept long enough

in lime, or the tan-pit, upon cleaving it in the middle, is seen a whitish streak, called the horn, or crudity of the skin; and this is the reason why the soles of shoes, boots, &c. stretch so easily, and take water.

When the hides are sufficiently tanned, they are taken out of the pit, to be dried, by hanging in the air: then the tan is cleaned off them, and they are put in a place neither too dry, nor too moist; they are well stretched over one another, with weights a-top, to keep them tight and strait; and in this condition are sold, under the denomination of *bend leather*. This is the method of tanning bullocks or oxes hides.

Cows, calves, and horses skins are tanned much after the same manner as those of oxen, except that the former are only kept four months in the lime-pit; and that before they be put in the tan, there is a preparation required, thus: cold water is poured into a wooden vat or tub, wherein the skins are put, which are kept stirring while some other water is a little more than luke-warm, it is poured gently into the vat, and upon this is cast a basket of tan; during which time, the skins are still kept turning, that the water and tan may not scorch them. After an hour, they are taken out, and cast for a day in cold water, then returned into the former vat, and the same water they had been in before; and here they are left eight days; which expired, they are put in the tan-pit, and three coverings of tan given them, the first of which lasts five weeks, the second six, and the third two months.

The rest of the process is in all respects the same as that above described. In some countries, as in Champagne, &c. the tanners give the first-preparation with barley, instead of lime.

CURRYING; a method of preparing leather with oil, or tallow; which raises on the hair, or wool-side, a kind of grain, not unlike that of morocco. Though there is a kind of curried leather without grain.

Currying is the last preparation, and puts the leather in a condition to be used for shoes, saddles, harness, &c. It is equally practised on sheep, calf, and bullocks-skins.

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The colours given in currying, are black, white, red, yellow, and green : the other colours are given by the skinners ; who differ from the curriers in this, that they apply their colours on the flesh side ; the curriers on the hair side.

Manner of currying in black, with the grain.—Of blacks there are four cases ; either the skins are put in tallow on both sides ; or oil is used, in lieu of tallow, on the flesh side ; or tallow is used alone on the hair side, and nothing on the other ; or tallow is used on both sides, but no grain raised.

The two first are used for cows and calves leather ; the second is the only way used for sheep ; and the two last are occasionally used for cow and bullock : for calf and sheep, they use sumac on the flesh side, which gives an orange cast.

For neats-skin in black ; the skin, coming from the tanner, is wet several times with a broom, rolled and trod under foot to make it tractable, drained, and as much of the remaining flesh, as possible, taken off with the knife ; hung in the air till half dry, then wet and trampled again and again.

This done, it is rubbed over with a pummel, or call, having niches in manner of teeth, to render it still more pliant ; and singed with straw, to prepare it to receive the tallow ; which is applied, boiling hot, on both sides.

The skin is thus singed a second time, laid four hours in a vessel of fresh water, trampled, and worked a second time with the pummel on each side, and stoutly drained ; smeared over with its first black, made of galls and ferailles, boiled in beer-aigre, or four beer ; half dried, stretched on a table, and the grain beat down with a flat iron instrument, drawn over it from place to place.

It now receives its second black, made of galls, copperas, and gum-arabic ; when dry, and stretched on a table, it is smeared over with beer-aigre ; then folded from corner to corner, and the pummel drawn over it to cut the grain, first on the hair side, then on the flesh side ; the last with a pummel of cork : the beer hanging in it is taken out with a hair rubber, boiled
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in hatter's lie ; and the skin fastened to the table, and cleaned with the iron instrument abovementioned, and again wiped with a piece of worsted stocking. The skin is now brightened on the hair side, with a lustre made of barberries, to prepare it to receive its last grain. The grain, we already observed, is begun, by folding the skin, the hair side inwards, several ways : to finish it, it is again folded, after its first lustre, two ways ; first from corner to corner, a little slanting ; then a-cross, i. e. first directly, or from eye to eye, then from head to tail.

The grain thus formed, the last lustre, which makes its last preparation, is given ; composed of gum-arabic, garlic, beer-vinegar, and Flanders size, boiled together, and applied cold.

Calf-skin, in black, is prepared much after the same manner, though begun differently. After wetting, taking off as much of the flesh remaining, as possible, and drying ; they pounce the flesh side with a hard, rough, pumice-stone, which makes it more smooth and gentle ; then give the grain with the pummel, put in the tallow : the rest as before.

Sheep-skins, in black.—What these have peculiar in their preparation is, that they are stretched on a table to get off the bourre, or tan wherewith they are loaden ; then wet, trod under foot, and tallow added to the hair side ; they are again wet, again trod, stretched on the table, and the water squeezed out with the pummel ; then blacked, repassed under the pummel on each side, dried, and all the roughness and inequality pared off with a flat, round, cutting-instrument : the rest as before.

Sleek-leather, or that without any grain, made of cows and bullocks skins, differs a little in its preparation from the former. The skins being wet, trod, and passed under the pummel, the flesh is taken off ; the rest as in the first article ; observing, that the tallow be applied on both sides as thick as possible ; being now steeped in water, trod, frized, and blacked the first time ; the second black is next laid on, till the hair side be quite smooth. Lastly, after receiving the two lustres,

tres, they are pressed between two tables; without plaiting or folding them in any manner during the whole preparation.

TAN; the bark of the oak, chopped and ground, by a tanning-mill into a coarse powder; to be used in tanning or dressing of skins.

New tan is the most esteemed; when old and stale it loses a deal of its effect, which consists in condensing or closing the pores of the skins; so that the longer the skins are kept in the tan the greater strength and firmness they acquire. Indeed, not only the bark, but every part of the oak-tree, of what age and growth soever, if cut in barking time, makes as good tan as the best bark.

This, when got, is to be well dried in the sun, housed dry and kept so. To use it the greater wood may be cleft small, and cut by a tanning engine, it is afterwards well dried again, on a kiln, and then ground by the mill. Thorns are used, sometimes to supply the defect, when oak is scarce.

The oak bark is more abundant in the gummy resinous part than any of our common indigeous astringents, and on account of this astringent gummy resinous property, it serves both to preserve leather from rotting, and to render it impervious to water, and is hence preferred to all other substances for the purpose of tanning.

PARCHMENT.—The antiquity of parchment is supported by Dr. *Prideaux*, who imagines that the authentic copy of the law, which *Hilkiah* found in the Temple, and sent to King *Josiah* was formed of this material; because no other used for writing, parchment excepted, could be of so durable a nature as to last from the time of *Moses* to that period, for eight hundred and thirty years. But it has been said in answer to this, that the Egyptians wrote on *linen* those things designed for long duration, and those who have examined mummies with attention, assure us that the characters so written continue to this day.

Parchment is a sheep or goat's skin, prepared after a peculiar manner, which renders it proper for several uses; particularly for writing on, and covering of books, &c.

Parchment is begun by the skinner, and ended by the parchment-maker. It constitutes a very considerable article in the French commerce: it is made in most of their cities: and besides the consumption at home, they send vast quantities abroad, particularly to England, Flanders, Holland, Spain and Portugal.

That called *virgin parchment*, and which superstitious people believe to be made of a kind of caul, wherein some children are inclosed in the womb, is nothing but a somewhat thinner and finer sort than the rest, proper for certain purposes, as fans, &c. and made of the skin of an abortive lamb, or kid.

Manufacture of parchment.—The skin having been stripped of its wool, and passed the lime-pit, the skinner stretches it on a kind of frame, consisting of four pieces of wood, mortised into each other at the four angles, and perforated lengthways from distance to distance, with holes, furnished with wooden pins that may be turned at pleasure, like those of a violin,

To stretch the skin on this frame, they make little holes all around it, and through every two holes draw a little skewer; to this skewer they tie a piece of small packthread, and tie that over the pins; so that coming to turn the pins equally, the skin is strained tight every way, like that of a drum.

The skin being thus sufficiently stretched on the frame, the flesh is pared off with a sharp instrument for the purpose, this done, it is moistened with a rag, and a kind of white stone or chalk reduced to a fine dust, strewed over it; then with a large pumice-stone, flat at bottom, much after the manner of a mullet for grinding colours, they rub over the skin as if about to grind the chalk; and thus scower off the remains of the flesh. They then go over it again with the iron instrument; again moisten it as before, and again rub it with the pumice-stone without any chalk underneath; this
smoothes

smoothen and softens the flesh-side very considerably. They drain it again, by passing over it the iron instrument as before.

The flesh-side thus drained, they pass the iron on the wool or hair-side; then, stretch it tight on the frame by means of the pins, and go over the flesh-side again with the iron: this finishes its draining; and the more the skin is drained, the whiter it ever becomes.

They now throw on more chalk, sweeping it over with a piece of lamb-skin that has the wool on; this smoothen it still further, and gives it a white down or nap. It is now left to dry, and when dried, taken off the frame, by cutting it all round.

The skin, thus far prepared by the skinner, is taken out of his hands by the parchment-maker; who scrapes or pares it dry on the summer, with an iron instrument like that above mentioned, only finer and sharper; with this, worked with the arm from top to bottom of the skin, he takes away about one half of its thickness. The skin thus equally pared on both sides, they pass the pumice-stone over both sides, to smoothen it. This last preparation is performed on a kind of form or bench covered with a sack stuffed with flocks, and leaves the parchment in a condition for writing on.

The paring the skin dry on the summer, is the most difficult preparation in the whole process of parchment-making; for which reason the skinners seldom dare meddle with it, but usually leave it to those more experienced in it: the summer whereon it is performed, is a calf-skin well stretched on a frame, serving as a support to the skin which is fastened a top of it with a wooden instrument that has a notch cut in it. Lastly, that the iron knife may pass the easier between the summer and the skin to be pared, they put another skin which they call the counter-summer. The parings thus taken off the leather, are used in making glue, size, &c.

VELUM, or *velom*, a kind of parchment, finer, even, and whiter than the common parchment. The word is formed from the French *velin* of the Latin *vittellinus*, belonging to a calf. *Chambers* observes that

what we call *vellum* is only *parchment* made of the skins of abortive calves, or at least of sucking calves; 'tis finer, whiter, and smoother than the common parchment, but is prepared in the same manner as that, abating that it is not passed through the lime-pit.

SHAMMY ; a kind of leather, either dressed in oil, or tanned : much esteemed for its softness and pliancy. It is prepared from the skin of the *chamois*, a kind of wild goat, on the mountains of Dauphine, Savoy, Piedmont, and the Pyreneans.

Besides the softness and warmth of the leather, it has the faculty of bearing soap without damage, which renders it very useful.

The true *chamoise leather* is counterfeited with common goat, kid, and even sheep-skin, the practice of which makes a particular profession.

SHAGREEN ; a kind of grained leather, chiefly used in the covers of cases, books, &c. It is very close and solid, and covered over with little roundish grains. It is brought from Constantinople, Taurus, Tripoli, Algiers, and some parts of Poland.

As to the manner of preparing : the skin being flead off, is covered with mustard-seed, and exposed to the weather for some days ; then tanned. The best is brought from Constantinople, of a brownish colour ; the white is the worst. It is extremely hard ; yet, when steeped in water, becomes very soft and pliable ; whence it becomes of great use among case-makers. It takes any colour that is given it, red, green, black, yellow. It is frequently counterfeited by *maroquin* formed like shagreen ; but this last is distinguished by its peeling off, which the first does not.

MOROCCO, or *Maroquin* ; the skin of a goat, or some other animal resembling it, called *menon*, frequent in the Levant ; dressed in sumac, or galls, and coloured of any colour at pleasure, much used in tapestry, book-binding, &c.

The name is ordinarily derived from the kingdom of Morocco, whence it is supposed the manner of preparing them was first borrowed.

We

We have morocco skins brought from the Levant Barbary, Spain, Flanders, and France; red, black, yellow, blue, &c. The various manners of preparing, moroccos, both black and in colours, are so curious, and withal so little known among us, that the public will not be displeased to find them here.

Manner of preparing red Morocco.—The skins are steeped twenty-four hours in a river, taken out, stretched on the leg, beat with the knife, returned into the water for twenty-four hours, rebated on the leg, re-steeped; thrown into a vat, and for three weeks, taken out and returned every morning, to dispose them to peel.—Being taken out for the last time, they are scraped with the knife, and when the hair is quite off, thrown in pails of fresh water, where they are rinsed: then the flesh side scraped, thrown into the pails, and thus alternately from the leg to the pails, till they leave the water quite clean: then they are put in luke-warm water, with the sumac, and after twelve hours, rinsed in clear water, and scraped, on the leg on both sides pounded in pails, and the water changed three times; then wrung and stretched on the leg, and passed after each other into water, with alum dissolved in it. Thus alumed, they are left to drain till the morning, then wrung out, pulled on the leg, and folded from head to tail, the flesh inwards.

In this state they receive their first dye, by passing them from one to another into a red liquor, prepared with lacca, and some other ingredients, kept secret among the maroquineers.—This they repeat again and again, till the skins have got their first colour. They are then rinsed in clear water, stretched on the leg, and left to drain twelve hours; thrown into water, into which white galls pulverized have been passed through a sieve, and stirred incessantly for a day with long poles, taken out, hung on a bar a-cross the water all night, white against red, and red against white, and in the morning the water stirred up, and the skins returned into it for twenty-four hours.

For *black Morocco*, instead of the *red liquor* above described, a black dye is prepared of sour beer, wherein pieces of rusty iron have been thrown, with the addition of other ingredients.

ERMINE, in heraldry, signifies black spots on a white field, but if the word *plain* be used with it, denotes nothing but white furs.

It is supposed to represent the skin of an animal of the same denomination ; which some say is a water rat, others a sort of weasel, and others an Armenian mouse. In short there is no animal whose skin naturally corresponds to the *herald's* ermine.

The animal is milk white ; and so far is it from spots, that it will rather die, or be taken, than fully its whiteness. Whence its symbolical use. But white skins having for many ages been used for the robes of magistrates and great men ; the furriers, at length, to add to their beauty, used to sew bits of black upon the white, to render them more conspicuous.

GLUE, *gluten*, a viscid, tenacious matter, serving as a cement to bind, or connect divers things together.

There are divers kinds of glues made use of in the divers arts ; as the common glue, glove glue, parchment glue—But the two last are more properly called size.

The common, or strong glue is a commodity used by numerous kinds of artificers ; as joiners, cabinet-makers, case-makers, hatters, book-binders, &c. And the consumption thereof is very considerable. The best is that made in England, in square pieces, of a ruddy, brown colour. Flanders glue is held the next after the English.

Glue is made of the skins of all kinds of beasts, as oxen, cows, calves, sheep, &c. The older the beast is, the better is the glue that is made of its hide. Indeed, it is rare they use whole skins for this purpose ; those being capable of being applied to better purpose : But they make use of the shavings, parings, or scraps thereof : sometimes they make it of the feet, sinews, nerves, &c. of beasts.

That

That made of whole skins is the best ; and that of sinews, &c. the worst : and hence chiefly arises the difference of glues ; and the advantage of the English and Flemish glues ; for, as our tanners generally make the glue themselves ; they are not sparing of the parings of the skins, which they never sell : whereas, in France, &c. the glue-makers being a peculiar kind of manufacturers, and having no parings, &c. but what they buy, make use chiefly of sinews, feet, &c.

Method of making glue.—To make glue of parings, they first steep them two or three days in water ; then washing them well out, they boil them to the consistence of a thick jelly. This done, they pass the jelly, while yet hot, through osier baskets, to separate from it any impurities ; and in order to purify it still further, they let it rest some time. When the ordures, or foreign matters are precipitated to the bottom of the vessel ; they melt and boil it a second time.

This done, they pour it into flat frames, or moulds ; whence it is taken out, when pretty hard and solid, and cut it into square pieces, or cakes. Nothing now remains, but to dry it in the wind, on a sort of coarse net, and afterwards to string it, to finish the drying.

The glue made of feet, sinews, &c. is managed after the same manner, with this only difference, that they bone and scour the feet, and don't lay them to steep.

The best glue is that which is oldest : the surest test of goodness, is to lay a piece to steep three or four days in water ; if it swell considerably without melting, and when taken out resume its former dryness, it is excellent.

Fish Glue is a sort of glue made of the nervous and mucilaginous parts of a large fish, found chiefly in the Russian seas.

Fish glue is of considerable use in medicine, and divers other arts ; where it is better known under the name of *ising-glass*.

HATS.

HATS are chiefly made of hair, wool, &c. worked, fulled, and fashioned to the figure of the head.

Hats are said to have been first seen about the year 1400; at which time they became of use for country wear, riding, &c. *F. Daniel* relates that when Charles II. made his public entry into Rouen in 1449, he had on a hat, lined with red velvet, and surmounted with a plume, or tuft of feathers. He adds, that it is from this entry, at least under this reign, that the use of hats and caps is to be dated, which henceforward began to take place of the chaperons and hoods, that had been wore before.

In progress of time, from the laity, the clergy likewise took the habit: but it was looked on as a crying abuse, and several regulations were published, forbidding any priest, or religious person, to appear abroad in a hat without cornets; and enjoining them to keep to the use of chaperons, made of black cloth, with decent cornets: if they were poor, they were at least to have cornets fastened to their hats, and this upon penalty of suspension and excommunication. Indeed the use of hats is said to have been of a longer standing among the ecclesiastics of Brittany, by two hundred years; and especially among the canons: but these were no other than a kind of caps; and it was from hence arose the square caps wore in colleges, &c.

Lobineau observes, that a bishop of Dol, in the twelfth century, zealous of good order, allowed the canons alone to wear such hats; enjoining, that if any other person should come with them to church, divine service should immediately stand still.

Hats make a very considerable article in commerce. The finest, and those most valued, are made of the pure hair of an amphibious animal, called *castor*, or *beaver*, frequent in Canada, and other provinces of North America.

Method of making hats.—Hats, we have observed, are made either of wool, or of hair of divers animals, particularly

particularly the castor, hare, coney, camel, &c.—
The process is much the same in all; for which reason
we shall content ourselves to instance in that of castors.

The skin of this animal is set with two kinds of hair;
the one long, stiff, glossy, and pretty scarce; this being
what renders the skin, or fur, of so much value.—
The other short, thick, and soft; which alone is used
in hats.

To tear off one of these kinds of hair, and cut the
other, the hatters, or rather the women employed for
that purpose, make use of two knives, a large one like
a shoemaker's knife, for the long hair; and a smaller,
not unlike a vine-knife, wherewith they shave, or
scrape off the shorter hair.

When the hair is off, they card the whole with cards,
like those used in the woollen manufactory, only finer.
This done, they weigh it, and take more or less, ac-
cording to the size or thickness of the hat intended.—
The stuff is now laid on the hurdle, which is a square,
table parallel to the horizon, having longitudinal chinks
cut through it. On this hurdle, with an instrument
called a bow, much resembling that of a violin, but
larger; whose string is worked with a little bow-stick,
and thus made to play on the furs; they fly and mix
them together, and dust and filth at the same time pas-
sing through the chinks. This they reckon one of the
most difficult operations in the whole: by reason of the
justness required in the hand to mix the stuff precisely
together, and that it may be every where of the same
thickness. In lieu of a bow, some hatters make use of
a sieve, through which they pass the stuff.

After this manner they form gores, or two capades,
of an oval form, ending in an acute angle atop. And
with what stuff remains they supply and strengthen
them in places where they happen to be slenderer than
ordinary. Though it is to be remembered, that they
designedly make them thicker in the brim, near the
crown, than towards the circumference, or in the
crown itself.

The capades thus finished, they go on to harden
them into closer, more consistent flakes, by pressing
down a hardening skin, or leather thereon. This done,
they

they are carried to the bason, which is a sort of bench with an iron plate fitted therein, and a little fire underneath it; upon which laying one of the hardened capades, sprinkled over with water; and a sort of mould applied thereon; the heat of the fire, with the water and pressing, imbody the stuff into a slight, hairy sort of stuff, or felt: after which, turning up the edges all around over the mould, they lay it by; and thus proceed to the other. This finished, the two are next joined together, so as to meet in an angle atop, and only form one conical cap, after the manner of a *manica Hippocrates*.

The hat thus basoned, they remove it to a large kind of receiver or trough, resembling a mill-hooper, going sloping, or narrowing down from the edge, or rim, to the bottom, which is a copper kettle, filled with water and grounds, kept hot for the purpose. On the descent, or sloping side, called the plank, the basoned hat, being first dipt in the kettle, is laid. And here they proceed to work it, by rolling and un-rolling it again and again, one part after another, first with the hand, and then with a little wooden roller; taking care to dip it from time to time: till at length by thus falling and thickening it four or five hours, it is reduced to the extent, or dimensions of the hat intended. To secure the hands from being injured by this frequent rolling, &c. they usually guard them with a sort of thick gloves.

The hat thus wrought, they proceed to give it the proper form; which is done by laying the conical cap on a wooden block, of the intended size of the crown of the hat; and thus tying it round with a packthread, called a commander: after which, with a piece of iron, or copper, bent for the purpose, and called a stamper, they gradually beat or drive down the commander all around, till it has reached the bottom of the block: and thus is the crown formed; what remains at bottom below the string, being the brim.

The hat being now set to dry; they proceed to singe it, by holding it over a flare of straw, or the like; then it is pounced or rubbed with pumice, to take off the coarser nap; then rubbed over afresh with seal-skin, to lay

lay the nap still finer; and lastly, carded with a fine card, to raise the fine cotton, with which the hat is afterwards to appear.

Things thus far advanced, the hat is sent, upon its block, and tied about with packthread as before, to be dyed. The dyer's copper is usually very large, holding ten or twelve dozen hats. The dye, or tincture, is made of logwood, verdigrise, copperas, and alder bark; to which some add galls and sumac.

After the hat is kept boiling for about three quarters of an hour; then taken out and set to cool, and then returned to the dye; and this for ten or twelve times successively.

The dye being complete, the hat is returned to the hatter, who proceeds to dry it, by hanging it in the top, or roof, of a stove or oven; at the bottom of which is a charcoal fire. When dry, it is to be stiffened, which is done with melted glue, or gum feneca, applied thereon by first smearing it, and beating it over with a brush, and then rubbing it with the hand.—The next thing is to steam it, on the steaming-bason, which is a little hearth, or fire place, raised three foot high, with an iron plate laid over it, exactly covering the hearth. On this plate they first spread cloths, which being sprinkled over with water to secure the hat from burning, the hat is placed, brim downwards, thereon. When moderately hot, the workman strikes gently on the brim, with the flat of his hand, to make the jointings incorporate and bind, so as not to appear; turning it from time to time, this way and that way, and at last overturning and setting it on the crown.

When steamed sufficiently, and dried, they put it again on the block, brush and iron it on a table, or bench for the purpose, called the stall-board. This they perform with a sort of irons like those commonly used in ironing linen, and heated like them; which being rubbed over and over each part of the hat, with the assistance of the brush, smoothen and gives it a gloss, which is the last operation.

FURRS,

FURRS, are the skins of divers kinds of wild beasts, dressed with the hair on; and used as a lining or doubling of garments, either for warmth or ornament.—The kinds of furs, or skins chiefly dressed in alum, and with the hair on, are those of the ermine, sable, squirrel, castor, otter, dog, fox, hare, wolf, tiger, bear, &c.

GOLD.

GOLD.—The nature of gold has been already described, under the class of Minerals—what follows relates to the manufactory of it.

In *separating the gold* they first break the metalline stone with iron mallets; then grind it with mills to a fine powder, and pass it through several sieves. The powder is then placed in troughs, with mercury and water. After this the water and earth are drove out of the troughs by means of other hot waters poured thereon. This done there remains nothing but the mercury and the ore. The mercury is afterwards separated by distillation, and the gold is melted, and cast into ingots.

For *refining gold*, they use either *antimony*, *sublimate*, or *aqua fortis*. Gold having the property which no other metal has, not even silver, of resisting the action of sulphur or antimony, &c. it may be purified by these agents from all metallic substances, and consequently may be refined. As none but the perfect metals can resist the combined action of air and fire without losing their inflammable principle, and being changed into earthy or vitreous matters, incapable of remaining any longer united with substances in a metallic state, there is then a possibility of purifying gold and silver from all alloy of imperfect metals, by only keeping them fused till all the alloy be destroyed. But as this method of refining is very long, difficult and expensive, a much shorter and more advantageous method has been discovered: which consists in adding to the alloyed gold and silver a certain quantity of *lead* and

and exposing afterwards this mixture to the action of the fire.

Gold wire, is a cylindrical ingot of silver, superficially gilt or covered with gold at the fire; and afterwards drawn successively through a great number of little round holes, of a wire-drawing iron, each less than the other, till it be sometimes no bigger than a hair of the head. It may be observed, that, before the wire be reduced to this excessive fineness, it is drawn through above an hundred and forty different holes; and that each time they draw it, it is rubbed afresh over with new wax, both to facilitate its passage, and to prevent the silver's appearing through it.

Gold wire flattened, is the former wire flattened between two rollers of polished steel, to fit it to be spun on a stick, or to be used flat, as it is, without spinning, in certain stuffs, laces, embroideries, &c.

Gold thread, or *spun Gold*, is flattened gold, wrapped, or laid over a thread of silk, by twisting it with a wheel. To dispose the wire to be spun on silk, they pass it between two rollers of a little mill; the gold wire is thus rendered quite flat, without losing any thing of its gilding; and is rendered so exceedingly thin and flexible, that it is easily spun on silk thread, by means of a hand wheel.

Gold leaf, or *beaten Gold*, is gold beaten with a hammer into exceeding thin leaves, so that it is computed that an ounce may be beaten into sixteen hundred leaves, each three inches square. That for the gold-wire is left much thicker than that for gilding picture frames.

The gold is beaten on a block of marble, commonly black marble, about a foot square. The hammers are of polished iron. The gold is first formed from the ingot to the thickness of a sheet of paper, then it is cut into pieces about an inch square; they are then beaten thinner, and again cut into several smaller pieces.

Gilding; the art of spreading or covering a thing over with gold, either in leaf or liquid. The art of gilding was not unknown among the ancients, though it never arrived among them at the perfection to which moderns have carried it. *Pliny* assures us, that the first gilding seen at Rome, was after the destruction of Car-

thage, under the cenforship of *Lucius Mummius*, when they began to gild the ceilings of their temples and palaces; the Capitol being the first place on which this enrichment was bestowed. But he adds, that luxury advanced on them so hastily, that in a little time you might see all, even private or poor persons, gild the very walls, vaults, &c. of their houses.

The modern gilders also, make use of gold leaves of divers thickneses; but there are some so fine, that a thousand do not weigh above four or five drachms. The thickest are used for gilding on iron, and other metals; and the thinnest, on wood. But we have another advantage over the ancients, in the manner of using or applying the gold: the secret of painting in oil, discovered of late ages, furnishes us with means of gilding works that shall endure all the injuries of time and weather, which to the ancients was impracticable. The lustre and beauty of gold have occasioned several enquiries and discoveries concerning the different methods of applying it to different substances. Hence the art of gilding is very extensive, and contains many particular operations, and various management. A colour of gold is given by painting and by varnishes, without employing gold; but this is a false kind of gilding. Thus a very fine golden colour is given to brass and to silver, by applying upon these metals a gold coloured varnish, which, being transparent, shews all the brilliancy of the metals beneath. Many ornaments of brass are varnished in this manner, which is called *gold lacquering*, to distinguish them from those which are really gilt. Silver leaves thus varnished are put upon leather, which is then called gilt leather.

Amongst the false gilding may also be reckoned those which are made with thin leaves of copper or brass, called *Dutch leaf*. In this manner are made all kinds of what is called *gilt paper*. In the true gilding, gold is applied to the surface of bodies. The gold intended for this purpose ought in general to be beat into thin leaves, or otherwise divided into very fine parts. As metals cannot adhere well merely by contact to any but to other metallic substances, when gold is to be applied to the surface of some unmetallic body, that surface must

must be previously covered with some gluey and tenacious substance, by which the gold will be made to adhere. The substances are in general called *sizes*. Some of these are made of vegetable and animal glues, and others of oily, gluey, and drying matters. Upon them the leaves of gold are applied, and pressed down with a little cotton, or a hare's foot; and when the whole is dry, the work is to be finished or polished with a hard instrument, called a *dog's tooth*, to give lustre.

When the work is required to be capable of resisting rain or moisture, it ought to be previously covered with a composition of drying oil and yellow ochre ground together: otherwise a water-size may be used, which is prepared by boiling cuttings of parchment, or white leather in water, and by mixing this with some chalk or whiting: several layers of this size must be laid upon the wood, and over these a layer of the same size mixed with yellow ochre. Lastly, another mixture, called *gold size*, is to be applied above these; upon which the gold leaves are to be fixed. This is composed of tobacco-pipe clay, ground with some ruddle or black lead, and tempered with a little tallow, or oil of olives. The edges of glasses may be gilt by applying, first, a very thin coat of varnish, upon which the gold leaf is to be fixed; and when the varnish is hardened, may be burnished. This varnish is prepared by boiling powdered amber with linseed oil, in a brass vessel to which a valve is fitted, and by diluting the above solution with four or five times its quantity of oil of turpentine: and that it may dry sooner, it may be ground with some white lead.

The method of applying gold upon metals is entirely different. The surface of the metal to be gilt is first to be cleaned; and then leaves are to be applied to it, which, by means of rubbing with a polished blood-stone, are made to adhere perfectly well. In this manner silver leaf is fixed and burnished upon brass in the making of what is called *French plate*, and sometimes also gold-leaf is burnished upon copper, and upon iron. Gold is applied to metals in several other manners.—One of these is by previously forming the gold into a paste or amalgam with mercury. In order to obtain a

small amalgam of gold and mercury, the gold is first to be reduced into thin plates or grains, which are heated red-hot, and thrown into mercury previously heated, till it begins to smoke. Upon stirring the mercury with an iron rod, the gold totally disappears. The proportion of mercury to gold is generally as six or eight to one. With this amalgam the surface of the metal to be gilded is to be covered; then a sufficient heat is to be applied to evaporate the mercury; and the gold is lastly to be burnished with a blood-stone.

Some metals, particularly silver, may be gilt in the following manner. Let gold be resolved into aqua-regia. In this solution pieces of linen are to be dipt, and burnt to black ashes. These ashes being rubbed on the surface of the silver by means of a wet linen rag, apply the particles of gold which they contain, and which by this method adhere very well. The remaining part of the ashes is to be washed off; and the surface of the silver, which in this state does not seem to be gilt, is to be burnished with a blood-stone till it acquire a fine colour of gold. This method of gilding is very easy, and consumes a very small quantity of gold. Most gilt ornaments upon fans, snuff-boxes, and other toys of much show and little value, are nothing but silver gilt in this manner.

Gold may also be applied to glass, porcelain, and other vitrified matters. As the surface of these matters is very smooth, and consequently is capable of a very perfect contact with gold leaves, these leaves adhere to them with some force, although they are not of metallic nature. This gilding is so much more perfect, as the gold is more exactly applied to the surface of the glass. The pieces are then to be exposed to a certain degree of heat, and burnished slightly to give them lustre. A more substantial gilding is fixed upon glass, enamel, and porcelain, by applying to these substances powder of gold mixed with a solution of gum arabic, or with some essential oil, and a small quantity of borax; after which a sufficient heat is to be applied to soften the glass and the gold, which is then to be burnished. With this mixture any figures may be drawn. The powders for this purpose may be made, 1. By grinding

ing gold-leaf with honey, which is afterwards to be washed away with water. 2. By distilling to dryness a solution of gold in aqua-regia. 3. By evaporating the mercury from an amalgam of gold, taking care to stir well the mass near the end of the process. 4. By precipitating gold from its solution in aqua-regia by applying to it a solution of green vitriol in water, or some copper, and perhaps some other metallic substances.

COINAGE, or Coining; the art, or act of making money.

Coining, is either performed by the hammer or the mill. The first method is now little used in Europe, especially in England, France, &c. though the only one known till the year 1553, when a new machine, or coining mill, having been invented by an engraver, one *Antoine Brucher*, was first tried in the French king's palace at Paris, for the coining of counters.— Though some attribute the invention of the mill to *Varin*, a famous engraver, who, in reality, was no more than an improver of it; and others to *Aubry Olivier*, who had only the inspection of it.

The mill has met with various fate since its first invention; being now used, and again laid by, and the hammer resumed: but it has at length got that footing, by the neatness and perfection of the species struck with it, that there appears no probability of its being again disused.

In either kind of coining, the pieces of metal are stamped, or struck with a kind of moles, or coins, wherein are engraven the Prince's effigies, with the arms, legend, &c. The manner of preparing and cutting of which, see under Engraving.

The first operations in coining are the mixing, and melting of the metal. For the first, it is to be observed, that there are no species coined of pure gold or silver, but always a quantity of alloy of copper is mixed with them: the reasons are partly the scarcity of those two metals, partly the necessity of making them harder by some foreign admixture; and partly to defray the expences of coining.

For the melting, if the metal be gold, it is done in earthen crucibles; if silver or copper, in iron ones.

There are two kinds of furnaces proper for the melting of metals; those with wind, and those with bellows.

When the gold or silver are entirely melted, they are poured into moulds, or frames, for casting them into plates, or sheets: the method of doing which, is exactly the same with that used by the founders, in sand.

The models are flat plates of copper, about fifteen inches long, and nearly of the thickness of the species to be struck. In each mould are placed eight of these to make plates for guineas, ten for half guineas, five for crowns, &c. and in proportion for copper. All the difference between casting the plates of gold, and those of other metals consisting in this; that the latter are taken out of the crucibles with ladles, and poured into the aperture of the mould; and that for gold, the crucible is taken off the fire with a kind of tongs, and thence poured into the mould.

Thus far the process is the same, in coining either with the mill or the hammer: when the plates are taken out of the moulds, the difference commences; so that here the article of coining divides into two branches.

Coining by the Mill, or milled money.—The plates being taken out of the moulds, scraped, and brushed, are passed several times through the mill, to flatten them, and bring them to the just thickness of the species to be coined; with this difference, however, that the plates of gold are heated again in a furnace, and quenched in water, before they undergo the mill; which softens, and renders them the more ductile: whereas those of silver pass the mill just as they are, without any heating; and when afterwards they are heated, they are left to cool again of themselves, without water.

The plates, whether gold, silver, or copper, thus reduced as near as possible to their thickness, are cut into round pieces, near the size of the intended species, with a cutting instrument, whose upper end is formed into a screw; which being turned by an iron handle, lets the steel, well sharpened, in form of a punch-cutter, fall on the plates; and thus is a piece punched out.

These

These pieces are now given to be adjusted, and brought by filing, or rasping, to the weight of the standard whereby they are to be regulated; and what remains of the plate between the circles is melted again.

The pieces are adjusted in a fine balance; and those which prove too light, are separated from those too heavy; the first to be melted again, and the second to be filed down. For it may be observed, that the mill through which the plates are passed, can never be so just, but there will be some inequality. This inequality, indeed, may be owing to the quality of the matter, as well as of the machine, some parts being more porous than others.

They are then carried to the blanching, or whitening house, i. e. the place where the gold pieces have their colour given them, and the silver ones are whitened; which is done by heating them in the furnace, and when taken out and cooled, boiling them successively in two copper vessels, with water, common salt, and tartar; and after scouring them well with sand, and washing them with common water, drying them over a wood fire, in a copper sieve, wherein they are put when taken out of the boilers. Then they are first marked with a legend, or engine, on the edges, to prevent the clipping and paring of the species.

The machine used to mark the edges, is very simple, yet ingenious; and so easy, that a single man is able to mark twenty thousand in a day: it is said to have been invented by the *Sieur Castaign*, engineer to the French king, and first used in 1685.

Lastly, the pieces are stamped, i. e. their impression given them in a press; which is a machine invented at the latter end of the sixteenth century.

Having now all their marks and impressions, both on the edges and faces, thus become money; but have not currency till they have been weighed and examined.

For the Coining of Medals, the process is the same, in effect, with that of money: the principal difference consists in this, that money having but a small relief, receives its impression at a single stroke; whereas, for medals, the height for their relief makes it necessary that the stroke be repeated several times: to this end,
the

the piece is taken out from between the coins, heated, and returned again; which process, in medallions, and large medals, is sometimes repeated fifteen or twenty times, ere the full impression be given; care being taken every time the planchet is removed, to take off the superfluous metal stretched beyond the circumference, with a file.

Add to this, that medallions, and medals of high relieve, by reason of the difficulty of stamping them in the balancier, or press, are usually first cast or moulded in sand, like other works of that kind, and are only put in the balancier to perfect them.

SILVER.—What has been said on gold-wire, &c. will partly apply to silver-wire, silver-leaf, &c. And also with regard to refining silver with lead: but *M. Homberg*, to shorten the operation, calcined the silver with half its weight of common sulphur; and after melting the whole, cast a quantity of steel filings upon it. Upon this the sulphur quits the silver, and the metal itself is found pure at the bottom of the crucible.

Lacquer is a varnish applied upon silver, tin, brass, &c. to preserve them from tarnishing, and to improve their colour. The basis of all lacquers, is a solution of the resinous substance called *seed-lac*, in spirit of wine, to which are added certain resinous colouring substances, such as gamboge and anotto; the former gives a yellow and the latter an orange colour. And when these colours are properly mixed they give a golden colour. When silver-leaf, or tin are to be lacquered, a larger quantity of the colouring materials is requisite than when intended to be laid on brass.

Tincture of silver is made by dissolving thin silver plates into spirit of nitre; and pouring the dissolution in another vessel full of salt water. By this means the silver is immediately precipitated into a very white powder: on this powder they pour rectified spirit of wine, &c. and the spirit of wine will at length assume a beautiful sky-blue colour, and becomes an ingredient in several medicines.

Silvering is the covering of any work with silver-leaf; as metals, wood, paper, &c. it is performed either with

with fire, oil, or size. Metal-gilders silver by fire; and painter-gilders all the other ways.

PLUMBERY; the art of casting, preparing, and working lead; and of using it in building, &c.

The lead used in plumbery is furnished from the lead-works in large ingots, or blocks, called pigs of lead; ordinarily weighing about an hundred pounds a-piece.

As this lead melts very easily, it is easy to cast figures hereof, of any kind, by running it into moulds of brass, clay, plaster, &c.

But the chief article in Plumbery, is the sheets, and pipes of lead. These make the basis of the plumbers work in building; the process of these, therefore, we shall give a description of:

Method of casting large sheets of lead.—The lead is melted in a large cauldron or furnace, near the furnace is the table, or mould, whereon the lead is to be cast. It consists of large pieces of wood, well jointed, and bound with bars of iron at the ends. Around it runs a frame, consisting of a ledge or border of wood two or three inches thick, and one or two high from the table.

The table is covered with fine sand; prepared, by moistening it with a watering pot, then working it with a stick; and at last, to render it smooth and even, beating it flat with a mallet, and planing it with a slip of brass or wood.

Over the table is a strike or rake of wood, which bears and plays on the edges of the frame by means of a notch cut in either end thereof; and so placed, as that between it and the sand is a space proportionable to the intended thickness of the sheet. The use of this strike is to drive the matter, while yet liquid, to the extremity of the mould.

A-top of the table is a triangular iron peel or shovel, bearing, before, on the edge of the table itself, and behind, on a trestle somewhat lower than the table.—Its use is in conveying the metal into the mould; with a large iron ladle they take the melted lead out of the furnace; and with this, fill the iron peel.

This

This done, they hoist up the lower part of the peel by its handle; upon which the liquid matter running off and spreading itself on the mould, the plumber conducts and drives it to the extremity of the table by means of the strike, which the workman passes along the ledges, and thus renders the sheet of an equal thickness.

The sheets thus cast, there remains nothing but to edge them, i. e. to planish the edges on both sides, in order to render them smooth and straight.

Method of casting thin sheets of lead.—The table or mould here used is of a length and breadth at discretion, only ledged on one side. Instead of sand they cover it with a piece of woollen stuff, nailed down at the two ends to keep it tight; and over this lay a very fine linen cloth. The feet of the table are uneven, so that it does not stand horizontal, but moderately inclined.

Great regard is had to the lead while melting, that it have the just degree of heat, so as it may run well, yet not burn the linen. This they judge of by a piece of paper; and if it be not shrunk and scorched a little, it is not hot enough.

Being then in its just degree, they have a strike, but different from that described in the former article: as serving both for peel and strike, to contain, and to conduct the liquid lead. It is, in effect, a wooden case without any bottom, only closed on three sides. It is pretty high behind, but the two sides, like two acute angles, still diminish to the tip.

The strike is placed a-top of the table, which is before covered in that part, with a pasteboard that serves as a bottom to the case, and prevents the linen from being burnt while the liquid is pouring in.

The strike is now filled with lead according to the quantity to be used; which done, two men, one at each side the table, let the strike descend down the table, or else draw it down with a velocity greater or less, as the sheet is to be more or less thick; the thickness of the sheet still depending on the promptitude wherewith the strike slides down the inclining mould.

These fine smooth sheets of lead are sometimes used between the joints of large stones in great buildings, &c.

Method

Method of casting pipes, without soldering.—To make these pipes they have a kind of furnace, consisting of a large iron furnace or cauldron, supported on a pretty high iron stand.

In this furnace they melt the lead, after first heating it with a fire underneath: To forward the fusion, they put in burning faggots along with the metal.—The metal is skimmed and laden off with the instruments mentioned above.

Near the furnace is a bench, furnished at one end with a little mill, with arms or levers to turn it withal. A strong girt, armed with an iron hook at one extremity, is fastened by the other to the axis of the mill, around which it turns when in motion. On this bench the moulds of the pipes are placed horizontally, and the mill and the girt serve to draw out the iron core after the pipe is cast.

The moulds of these tubes are of brass, and consist of two pieces, which open and shut by means of hooks and hinges; their inner diameter, is according to the size of the pipe to be made: their length is usually two foot and a half.

In the middle is placed a core, or round piece of brass or iron, somewhat longer than the mould, and of the thickness of the inner diameter of the pipe.—This core is passed through two copper rundles, one at each end of the mould, which they serve to close, and to these is joined a little copper tube about two inches long, and of the thickness the leaden pipes is intended to be of. By means of these tubes the core is retained in the middle of the cavity of the mould.

The core being in the mould, and the lead melted in the furnace: they take it up in a ladle, and pour it into the mould by a little aperture at one end, made in form of a funnel.

When the mould is full, and the metal cold, they pass the hook of the girt into a hole at the end of the core, and turning the mill with the hand, draw out the core. They then open the mould, and take out the pipe.

If they desire to have the pipe lengthened; they put one end thereof in the lower end of the mould, and pass

pass the end of the core into it; then shut the mould again and apply its rundle and tube as before, the pipe just cast serving for rundle, &c. at the other end.

Things thus replaced, they pour in fresh metal into the mould; thus repeating the operation till they have got a pipe of the length required.

Pipes made of sheet-lead soldered.—The plumbers have wooden cylinders, or rollers, of the length and thickness required; and on these they form their pipes, by wrapping the sheet around them: folding up the edges all along, thus.—After grating the lead well with a grater, they rub rosin over the part thus grated; then pour on it some solder melted in a ladle, or else melt it with a hot folding iron, sineering those parts where they would not have the solder catch with chalk, or the soil of the hand.

The solder which the plumbers use is a mixture of two pounds of lead with one of tin.

TIN.—The mineral ore, being taken from the mine, is broke in pieces with large iron mallets; then brought to a stamping mill, where it is still beaten smaller, and the water, passing through, washes away the earthy parts, leaving the metallic ones behind. This done they dry it in a furnace on iron plates, and grind it fine; then wash and dry it again; and in this state it is called *block-tin*. To convert it into *tin*, i. e. white tin they carry it to a furnace, where it is melted; when cold they forge it. Before it is exposed to sale in Cornwall it is carried to one of the five coinage towns, and after examination the arms of the Duchy of Cornwall are impressed with a hammer, and then it is called white tin. The duty on coinage, which is four shillings in the hundred-weight, belongs to the Prince of Wales, as Duke of Cornwall, and produces a revenue of upwards of 10,000*l.* per annum.

Tin-plates are an article of manufacture very common among us, and vulgarly called tin. It is iron plated over with tin. The French call it *fer blanc*, *white iron*, as we sometimes do in England. In the year 1681, tin plates were made in England by one Andrew Yarranton, who was sent to Bohemia to learn the

the manner of making them. But the manufacture was discontinued by his employers, and afterwards so much disregarded, as to be reckoned among the projects, called the bubbles of the year 1720; however it was revived, and brought to such perfection in the year 1740, that very little of it was imported from foreign parts, our own plates being of a finer gloss, than that beyond sea, the latter being hammered, and ours being drawn under a rolling-mill. *And, Hist. Com.*

Its particular use need not be described, being so generally known for its excellence in the numerous culinary utensils and other purposes.

FOUNDERY, or Foundry; the art of melting and casting all sorts of metals; particularly brass, iron, bell-metal, &c.

The word is also used for a place, or house, furnished with furnaces, or forges for their purpose.

Foundry of small works, or the manner of casting in sand.—The sand used by the founders, in casting of brass, &c. is yellowish, pretty soft, and greasy; but after it has been used, becomes quite black, by reason of the charcoal dust used in the moulds. Every time they would use this sand, they work it several times over.

Then, taking a wooden board, or table, of a length and breadth proportional to the quantity of things to be cast; round this they put a frame, or ledge, and thus make a sort of mould. This mould they fill with the sand before prepared, and a little moistened.—Which done, they take wooden, or metalline models, or patterns of the things intended to be cast; apply them on the mould, and press them down into the sand, so as to leave their form indented. Along the middle of the mould is laid half a little cylinder of brass, which is to be the master jet, or canal for running the metal; being so disposed as to touch the ledge at one side, and only to reach to the last pattern on the other.

From this are placed several lesser jets, or branches, reaching to each pattern, whereby the metal is conveyed through the whole frame.

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After the same manner they proceed to work the counter part, or other half of the mould, with the same patterns, in a frame exactly like the former; excepting that it has pins, which entering holes corresponding thereto in the other, make, that when the two are joined together, the two cavities of the pattern fall exactly on each other.

When both parts of the mould are sufficiently dried, they join them together, by means of pins; and to prevent their starting or slipping aside by the force of the metal, which is to come in flaming hot through a hole contrived at the master jet, they lock them in a kind of press, either with screws; or, if the mould be too big, with wedges.

The moulds thus put in the press, are ranged near the furnace, to be in readiness to receive the metal as it comes out of the crucible. While the moulds are thus preparing, the metal is put in fusion in an earthen crucible.

The furnace wherein the fusion is made, is much like the Smith's forge; having like that, a chimney, to carry off the smoke; a pair of bellows to blow up the fire; and a massive, or hearth, where the fire is made, and the crucible placed. It is the use of this massive, that chiefly distinguishes the furnace from the forge.

In the middle thereof is a square cavity, divided into two, by an iron grate; the upper partition serving to hold the crucible and the fuel; and the lower, to receive the ashes. When the fuel is well lighted, they put the crucible full of metal in the middle, and cover it with an earthen lid.

The metal being brought to a fluor, they fill the crucible with pieces of brass, beaten in a mortar — Nothing now remains but for the founder to take the crucible out of the fire, and carry it in a pair of iron tongs to the mould, into which he pours it, through the hole answering to the master jet of each mould. — Thus he goes successively from one to another, till his crucible is emptied. Then casting cold water upon the moulds, they take the frames out of the presses, and the cast-works out of the sand, which they work again for another casting. Lastly, they cut

off the jets, or casts, and sell, or deliver the work to those who bespoke it, without any further repairing.

Foundry of statues, great guns, and bells.—The art of casting statues in brass, is very ancient; insomuch, that its origin was too remote and obscure, even for the research of *Pliny*, an author admirably skilled at discovering the inventors of other arts.

All that we can learn for certain, is, that it was practised in all its perfection first among the Greeks, and afterwards among the Romans; and that the number of statues consecrated to the gods and heroes, surpassed all belief.

The single cities of Athens, Delphos, Rhodes, &c. had each three thousand statues; and *Marcus Scaurus*, though only *Ædile*, adorned the circus with no less than three thousand statues of brass, for the time of the Circensian games.

This taste for statues was carried to such a pitch, that it became a proverb, that in Rome, the people of brass were not less numerous than the Roman people.

Among us, the casting of statues was but little known, or practised before the seventeenth century.

As to the casting of guns, it is quite modern; and it were perhaps to be wished, we were as ignorant of it as the ancients. All authors agree, that the first cannon were cast in the fourteenth century; though some fix the event to the year 1338; and others to 1380.

The casting of bells is of a middle standing, between the other two.—The use of bells is certainly very ancient in the western church; and the same were likewise used in the church of the east. But at present *F. Vansleb* assures us, in his second account of Egypt, he found but one bell in all the eastern church, and that in a monastery in the upper Egypt.

The matter of these large works is rarely any simple metal, but commonly a mixture of several, as brass, bell-metal, &c.

Method of casting Statues, or figures.—There are three things chiefly required in casting statues, busts, basso-relievo's, vases, and other works of sculpture; viz. the mould, wax, and shell or coat.

The inner mould, or core, is a rude, lumpish figure, a little resembling the statues. It is raised on an iron grate, strong enough to sustain it, and is strengthened within by several bars or ribs of iron.

It may be made indifferently of two sorts of matter at the discretion of the workmen, viz. potters clay mixed up with horse dung and hair; or of plaister of paris, mixed with fine brick-dust.

The use of the core in statues is to lessen the weight, and save metal. In bells it takes up all the inside, and preserves the space vacant where the clapper is hung. In great guns it forms the whole chase, from the mouth to the breech: and in mortars, the chase, and chamber.

The wax is a representation of the intended statue in wax. If it be a piece of sculpture, the wax must be all of the sculptor's own hand, who usually fashions it on the core itself. Though it may be wrought a-part in cavities moulded, or formed on a model, and afterwards disposed and aranged on the ribs of iron over the grate, as before; filling the vacant space in the middle with liquid plaister, and brick dust; by which means the inner mould, or core is formed in proportion as the sculptor carries on the wax.

When the wax (which is to be the intended thickness of the metal) is finished, they fix little waxen tubes, perpendicularly to it, from top to bottom; to serve both as jets for the convenience of the metal to all parts of the work, and as vent holes, to give passage to the air, which would otherwise occasion great disorder, when the hot metal came to encompass it. By the weight of the wax used herein, is that of the metal adjusted; ten pound of this last being used to one pound of the former.

The work brought thus far, wants nothing but to be covered with its shell; which is a kind of coat, or crust laid over the wax; and which being of a soft matter, and even at first liquid, easily takes and preserves the impression of every part thereof, which it afterwards communicates to the metal, upon its taking the place of the wax between the shell and the mould.

The matter of this outer mould, or shell, is varied according as different layers or strata are applied. The first

first is a composition of clay and old crucibles well ground, and sifted, and mixed up with water, to the consistence of a colour for painting. Accordingly, they apply it with a pencil, laying it seven or eight times over; for the second impression they add horse's dung, and natural earth to the former composition. The third impression is only horse dung and earth. Lastly, the shell is finished by laying on several more impressions of this last matter made very thick with the hand.

The shell thus finished is secured and strengthened by several bands or girts of iron wound around it at half a foot's distance from one another, and fastened at bottom to the grate under the statue, and a-top to a circle of iron, where they all terminate.

If the statue be so big, that it would not be easy to move the moulds when thus provided, it must be wrought on the spot where it is to be cast.

This is performed two ways: in the first, a square hole is dug under ground, much bigger than the mould to be made therein and its insides lined with walls of freestone or brick. At the bottom is made a hole of the same materials, with a kind of furnace, having its aperture afterwards. In this is a fire to be lighted, to dry the mould and outwards to melt the wax. Over this furnace is placed the grate; and on this the mould, &c. framed as above explained. Lastly at one of the edges of the square pit is made another large furnace to melt the metal, as hereafter mentioned.

In the other way, it is sufficient to work the mould above ground; but with the same precaution of a furnace, and grate underneath. When finished, four walls are to be run up round it; and by the side thereof a massive made for a melting furnace. For the rest, the method is the same in both.

The moulds being finished, and inclosed between four walls, whether under ground, or above it; a moderate fire is lighted in the furnace under it; and the hole covered with planks, that the wax may melt gently down, and run out at pipes contrived for the purpose at the foot of the mould, which are after-

wards very exactly closed with earth, as soon as all the wax is carried off.

There remains now nothing but to melt the metal, and run it into the mould. This is the office of the furnace above, which is made in manner of an oven, with three apertures; one to put in the wood, another for a vent, and a third to run the metal out at. From this last aperture, which is kept very close all the time the metal is in fusion, a little tube or canal is laid, whereby the molten metal is conveyed into a large earthen basin over the mould, into the bottom of which all the big branches of the jets, or casts, which are to carry the metal into all the parts of the mould, are inserted.

It must be added, that these jets are all terminated, or stopped with a kind of plugs, which are kept close, that upon opening the furnace, the brass, which gushes out like a torrent of fire, may not enter any of them, till the basin be full enough of matter to run into them all at once: upon which occasion they pull out the plugs, which are long iron rods, with a head at one end, capable of filling the whole diameter of each tube. The hole of the furnace is opened with a long piece of iron, fitted at the end of each pole; and the mould filled in an instant.

The work is now finished; at least so much as belongs to the casting; the rest being the sculptor or carver's business; who, taking the figure out of the mould and earth, it is encompassed with, saws off the jets wherewith it appears covered over, and repairs it with instruments proper to his art, as chisels, gravers, punches, &c.

The manner of casting bells.—What has been hitherto shewn of the casting of statues, holds, in proportion, of the casting of bells: all that there is particular in these latter, is as follows.

First, then, the metal is different; there being not in the metal of statues, but no less than a fifth part in that of bells. Secondly, the dimensions of the core, and the wax of bells, especially if it be a ring of several bells that is to be cast, are not left to chance, or the caprice of the workman; but must be measured on a kind of

of scale, which gives the height, aperture, and thickness necessary for several tones required.

It need not be added, that it is on the wax, that the several mouldings, and other ornaments and inscriptions to be represented in relievo on the outside of the bell, are formed.

The clapper, or tongue, is not properly a part of the bell, but is furnished from other hands. In Europe, it is usually of iron, and is suspended in the middle of the bell. In China it is only a huge wooden mallet, struck by force of arm against the bell: whence they can have but little of that consonancy so much admired in some of our rings of bells.

Manner of casting great guns, or pieces of artillery.—

The casting of cannons, mortars, and other pieces of artillery, is performed like that of statues and bells; especially as to what regards the mould, wax, shell, furnaces, &c.

As to the metal, it is somewhat different from both; as having a mixture of tin which is not in that of statues; and only having half the quantity of tin that is in bells, i. e. at the rate of ten pounds of tin to an hundred of copper. A cannon is always shaped a little conical, being thickest of metal at the breech, where the greatest effort of the gun-powder is made, and diminishing thence to the muzzle: so that if the mouth be two inches thick of metal, the breech is six.

Its length is measured in calibers, i. e. in diameters of the muzzle. Six inches at the muzzle require twenty calibers, of ten feet in length: there is about one sixth of an inch allowed play for the ball.

There is a large Iron Foundry, two miles from Falkirk in Scotland, called *Carron Works*. Above one hundred acres of land have been converted into reservoirs and pools, for water diverted from the river, by magnificent dams built about two miles above the works, which, after turning eighteen large wheels, falls into a tide navigation that conveys their castings to the sea. These works are the greatest of the kind in Europe, and were established in 1760. At present the buildings are of vast extent; and the machinery is the first
in

in Britain; both in elegance and correctness. There are 1600 men employed, to whom is paid weekly above 650*l.* sterling, which has greatly enriched the adjoining country. 6500 tons of iron are melted annually from the mineral; and cast into cannon, cylinders, &c. In the founding of cannon, these works have lately arrived at such perfection, that they make above 5000 pieces a-year; and their guns of *new construction*, are the lightest and neatest now in use, not excepting brass guns. The present proprietors are a chartered company, with a capital of 150,000*l.* sterling.

The words Crucible and Forge having been repeatedly used, it may be proper to explain their meaning.

Crucible is a little vessel, commonly of earth, sometimes of iron, without any handle; wherein chymists, coiners, goldsmiths, and other artificers used to melt gold, silver, &c.

Earthen crucibles are made of potter's clay, and commonly hold about eight hundred ounces: The iron ones are larger, some holding ten thousand ounces.

Forge signifies a kind of little furnace, wherein smiths and other artificers heat their metals. The word *forge* is also used for a large furnace, wherein iron ore taken out of the mine is melted down, though this is not so properly a forge as a furnace. A forge is more properly used for another kind of furnace, wherein the pigs of metal are heated and fused; and beaten with large hammers, and thus rendered softer, ductile and fit for use. Of these forges there are two kinds, which the iron successively passes through, before it comes to the smith.

Forge-mills are turned by water, which serves to raise and let fall one or more huge hammers, to beat and form the iron into bars, anchors, or other massive works.

LETTER-FOUNDRY, *or the manner of casting printing letters.*—The two things principally to be regarded in the casting of letters, are the *matter* and the *matrices*.

The matter is a compound metal ; partly copper, and partly lead, mixed in a certain portion, which every letter-founder regulates at his own discretion, and to which he frequently adds a certain quantity of some other metal or mineral, as his experience directs him, to render his composition the harder.

The most usual proportion of the two metals, is a hundred pound of lead to twenty or twenty-five pound of brass. Some use iron, instead of brass ; in the proportion of a hundred pound of lead, to thirty or thirty-five of iron.

These metals are melted separately ; the brass, or iron with antimony, and the lead by itself. When in fusion, they are mixed together : this fusion, and mixture are the most laborious parts of the letter-founder's art.

The matrices of the letters are pieces of copper, whereon the impresson of the intended character has been cut, or struck in creux, by means of puncheons, &c. graven in relievo.

Each letter has its proper matrix : and there are particular ones for points, figures, rules, head pieces, and other ornaments of printing : excepting the quadrats, which being only of lead, and not intended to leave any impresson, are cast without matrices, and only in moulds : and each matrice has its puncheon made of steel, or iron, well tempered.

The matrices being struck, and touched up, or repaired, where needful, are put each at the end of an iron mould, inclosed between two thin pieces of board, two or three inches square ; the two upper angles being cut off, so as to compose an irregular hexagon.

Every thing belonging to the mould being disposed, they begin to prepare the matter.—The furnace, whereon the bason is placed for the metal to be melted in, is made of the same matter as crucibles.

Over the furnace is placed the melting bason, or copper. Its matter is a kind of pot metal ; and that it may be fit for melting both hard and soft metals, it is divided into two equal parts, by a perpendicular partition.

In this basin they melt only the matter already prepared ; that is, the mixture or composition made in the crucibles above mentioned. A little iron ladle serves to skim off the scoræ or impurities from the melted metal. These scoræ are not all lost, but serve to melt over again.

Two workmen are employed at each furnace ; they have a table where they lay the characters as fast as they are cast.

To run the metal into the mould, the founder holds in his ladle just enough for one letter.

Having filled this ladle with liquid metal, he pours it through a jet, or funnel, into the matrix or character. He then opens the mould, and takes out the character ; and without loss of time shuts it again, replaces the matrix, and casts a new letter. It is incredible with what expedition and address all this is done. The letter being cast, they view it, before they break off the jet ; to see whether it be perfect ; otherwise they throw it among the refuse of the fount.

With a knife they scrape the letter, to smooth its sides, and fit them to be rubbed on the stone.

The stone they grind them on, is a sort of hard, coarse-grained free-stone, placed horizontally ; before which the workman sits ; and works each side of the letter backwards and forwards : so that the stander-by would be easily deceived.

The compository, is a wooden ruler, with a little edge at bottom, against which the letters are ranged.

On the same instrument the quadrats, rules, borders, &c. are adjusted.

When the letters are composed, they remain to be justified, both as to thickness and height. In order to this, they use a little copper-plate, which is their level.

The justification, as to thickness, is made on a piece of marble ; and that for the height on an iron compository. The justification of the height, is guided by the *m* of some body of characters already justified.

Letters are said to be of their just height, when the part of the plate, or level bears equally on the standard *m* placed on its foot, in the little compository, and on the face of two letters newly cast placed aside of it to be

be justified : as to the thickness, the justification is performed by laying the standard letter on a little marble, and two new letters a-side of it ; and thus leveling the three, with the plate.

All that remains, is to dress the letters, *i. e.* to cut the foot, or rather hollow it, and make that sort of groove which every letter has at bottom, pretisely opposite to the eye or upper part, or face of the letter.

In order to this, they turn a long line of them upside down in the justicator ; which is an instrument of polished iron or steel, consisting of two long pieces joined together by screws. Between these two, they enclose as many letters as it will hold, all placed against each other in the same situation, as when composed for books ; excepting that the face in the former case is downwards, and the foot a-top. When the justicator is full of letters, they set it on the table of the cutter, between two cheeks of wood ; which pressing it very tight, enable the workman to run his plane along the line of the letters thus inverted.

The cutter is a steel instrument, in manner of a chissel ; serving to pare off the rough edge of the letters when they are dressed.

The letters are now fit for the printers use. The perfection of letters thus cast, consists in their being all severally square and strait, on every side ; and all, generally of the same height, and evenly lined, without stooping one way or other ; neither too big in the foot nor the head : well grooved, ground, barbed, and scraped ; with a sensible notch, &c.

An inspection of these letters themselves, will assist the reader in understanding this description, and afford a clearer idea than can be otherwise conceived.

FOUNT, or *Font*, among printers, &c. a set, or quantity of characters, or letters of each kind ; cast by the letter-founder, and sorted.

We say, a founder has cast a fount of *pica*, of *english*, *pearl*, &c. meaning, he has cast a set of characters of these kinds.

A complete fount does not only include the running letter : but also single letters, double letters, points, commas,

commas, lines, borders, head-pieces, tail-pieces, and numeral characters.

The letter-founders have a kind of list, or tariff, whereby they regulate their founts. The occasion thereof is, that some letters being much more in use, and oftener repeated than others, their cells, or cases should be better filled and stored than those of the letters which do not return so frequently. Thus the *o* and *i* for instance, are always in greater quantity than the *k* or *z*.

This difference will be best perceived from a proportional comparison of those letters with themselves, or some others.

Suppose a fount of an hundred thousand characters, which is a common fount; here the *a* should have five thousand; the *c* three thousand; the *e* eleven thousand; the *i* six thousand; and the rest of the letters in proportion.

But this is only to be understood of the letters of the lower-case; those of the upper having other proportions, which it would be here too long to insist on.

JAPANNING; the art of varnishing and drawing figures on wood, in the same manner as is done by the natives of Japan in the East-Indies. The substances which admit of being japanned, are almost every kind that are dry and rigid, or not too flexible; as wood, metals, leather, and paper prepared. Wood and metals do not require any other preparation, but to have their surface perfectly even and clean: but leather should be securely strained, either on frames or on boards, as its bending or forming folds would otherwise crack and force all the coats of varnish; and paper should be treated in the same manner, and have a previous strong coat of size; but it is rarely made the subject of japanning, till it be converted into *papier maché*, or wrought by other means into such form, that its original state, particularly with respect to flexibility, is lost.

One principal variation from the method formerly used in japanning is, the using, or omitting any priming, or under coat in the work to be japanned. In the older practice, such priming was always used; and

is at present retained in the French manner of japaning coaches and snuff-boxes of the *papier maché*; but on the Birmingham manufacture, it has always been rejected. The inconvenience in an under coat of size is, that the japan coats laid thereon will be constantly liable to crack and peel off by any violence, as may be easily observed by comparing the Paris and Birmingham snuff-boxes: the latter, when good of their kind, never peel or crack; while the Parisian Japan crack and fly off in flakes. On this account the Birmingham manufacture is greatly preferable to the French.

The laying on their colours in gum-water, instead of varnish, is also another variation from the old practice, but the much greater strength of the work when laid on in varnish or oil, prevails with great reason in all regular manufactories: however, they who practise japaning on such pieces as are not exposed to much violence, may paint with water colours, and then finish with the proper coats of varnish: and if the colours are tempered with the strongest isinglass, size, and honey, instead of gum-water, and laid on very flat and even, the work will not be much inferior in appearance to that done in oil, and will last a long time.

VARNISH is a thick, glossy liquor; used by painters, gilders, and other artificers, to give a gloss and lustre to their works, and also to defend them from the weather.

There are several kinds of varnish. The *white varnish* is made of oil of turpentine, fine turpentine, and mastic. *Drying varnish* is made of oil, turpentine and sandarac melted together. The *common varnish* is only common turpentine, dissolved in oil of turpentine. The word varnish is also used for the glossy coat, wherewith potter's ware, China ware, &c. are covered to give them a lustre. Melted lead, or smalt, are used for the first; but the true varnish used by the Chinese to give that inimitable lustre to their porcelain is one of the grand secrets in their manufacture.

ENAMEL is a kind of metalline colour used in enamelling. Enamels have for their basis a pure crystal glass, or frit, ground up with a fine calx of lead and tin, prepared for the purpose. These ingredients baked together are the matter of all enamels, which are made by adding colours of this or that kind of powder to this matter and melting or incorporating them together in a furnace. There is an enamel for imitating precious stones; and there is a kind used by jewelers and goldsmiths, on gold, silver, and other metals; and there is what is generally called *Painting in enamel*. This is a method of painting with metalline colours, ground, reduced to a powder, and used like other colours, with a pencil; then fused, baked again and vitrified by force of fire. The art of painting in enamel is very ancient; and appears to have been first practised on earthen, or potters ware. As early as the days of *Porfenna*, king of Tuscany, we hear of beautiful vases made in his territories; enamelled with various figures; though far short of those afterwards made at Faenza, in the time of *Raphael*, and *Michael Angelo*. There are still some of these vases in the cabinet of antiquaries; in all which the design, or drawing, is much better than the colouring. For they were at that time only acquainted with two colours, black and white; excepting a faint kind of carnation for the face and other parts.

In the time of *Francis I.* of France, the art was retrieved, and abundance of valuable pieces were produced there in the manner of the ancients.

There are two ways of painting in enamel; the one with clear and transparent; and the other with thick and opaque colours. To use the first, they are only ground up with water; the second are ground up with oil of aspic. The first is laid on the metal flat: but the invention of opaque colours, is much later and greatly preferable. All metals will not equally admit both kinds. Copper for instance, will not bear the transparent ones; but gold receives all kinds equally and perfectly well. It must be observed, however, that only the finest gold must be used herein. It is to the method of painting in thick, or opaque enamel that

that we all owe our fine modern pieces, representing portraits to as much perfection as the best painting in oil, and even some history pieces ; with this advantage, that their beauty and lustre never decay.

For this art, we are in some measure indebted to the French ; nothing of this kind having been attempted before 1630. when *Jean Toutin*, a gold-smith, and a great master in the common way of painting with transparent enamel, first applied himself to use thick colours of different teints, which should melt with fire, yet retain their lustre and purity. Several from him learnt the art and succeeded in bringing it to considerable perfection. The English seem to have been the first who applied with success to the painting of portraits.

M. Felibien, observed that the first and most finished portraits, and those of the finest colours, were brought into France by *Petitot* and *Bordier*, from England.

As to the method of painting, when the gold plate is enamelled in white, the draught or design to be painted, must be chalked thereon, and afterwards the whole drawn out. This draught or outline, thus finished, the piece is set to the fire, and then painted with the necessary colours. As painters in oil, retouch their colours several times, and let them dry ; so in this sort of painting they touch the piece as often as they please ; setting it each time to a reverberatory fire, and taking it away again, as soon as the enamel has got its full polish. The *reverberatory fire* is made in a little furnace, wherein there is fire both a-top and all round, only a void place in the middle, where the piece is to be put for the enamels to melt. The colours are laid on with the point of a pencil, as in miniature.

There is a method of enamelling by the flame of the lamp. The lamp is of copper or tin ; but the process is as needless as it is difficult to describe.

PRINTING ; the art of taking impressions from characters or figures moveable or immoveable, on paper, linen, silk, &c. There are three kinds of printing ; the one from moveable letters, for books : another from copper-plates, for pictures ; and the last from blocks, in which the representation of birds, flowers,

&c. are cut, for printing calicoes, linen, &c. The first is called *common* or *letter-press* printing; the second, *rolling-press* printing; and the last, *calico*, &c. printing. The principal difference between the three consists in this, that the first is cast in relievo, in distinct pieces; the second engraven in creux; and the third cut in relievo, and generally stamped, by placing the block upon the materials to be printed, and striking upon the back of it.

Letter-press Printing.—Of the above branches, this is the most curious, and deserves the most particular notice: for to it are owing chiefly our deliverance from ignorance and error, the progress of learning, the revival of the sciences, and numberless improvements in arts, which, without this noble invention, would have been either lost to mankind, or confined to the knowledge of a few.

History of Printing.—Some writers have ascribed the origin of this art to the East, and affixed a very early period to its invention; particularly *P. Jovius*, from whom *Osorius* and many others have embraced the same opinion. But these have evidently confounded the European mode of printing, with the *engraved tablets*, which to this day are used in China. The invention of these tablets has been ascribed, by many writers, even to an earlier period than the invention of the Christian æra; but is with more probability assigned, by the very accurate *Phil. Couplet*, to the year 930. The *Historia Simensis of Abdalla*, written in Persic in 1317, speaks of it as an art in very common use. The honour of having given rise to the European method has been claimed by the cities of Harleim, Mentz, and Strasburg. And to each of these it may be applied in a qualified sense, as they made many improvements upon one another.

The first testimony of the inventor is that recorded by *Hadrian Junius*, in his *Batavia*: He ascribes the invention to *Laxrentius*. His narrative was thus: "That, walking in a wood near the city (as the citizens of opulence used to do), he began first to cut some letters upon the rind of a beach-tree; which, for fancy sake, being impressed on paper, he printed one or two lines, as a specimen for his grand-children (the sons of his

his daughter) to follow. This having happily succeeded, he meditated greater things, as he was a man of ingenuity and judgment; and first of all, with his son in law, *Thomas Peter*, who, by the way, left three sons, who all attained the consular dignity, invented a more glutinous writing-ink, because he found the common ink sunk and spread; and then formed whole pages of wood, with letters cut upon them. A new invention never fails to engage curiosity. And when a commodity never before seen excited purchasers, to the advantage of the inventor: the admiration of the art increased, dependents were enlarged, and workmen multiplied. Among these was one *John*, whether, as we suspect, he had ominously the name of *Faustus*, unfaithful and unlucky to his master, or whether it was really a person of that name, we shall not much inquire. This man, bound by oath to keep the secret of printing, when he thought he had learned the art of joining the letters, the method of casting the types, and other things of that nature, taking the most convenient time that was possible, on Christmas-eve, when every one was customarily employed in lustral sacrifices, seizes the collection of types, and all the implements his master had got together, and, with one accomplice, marches off to Amsterdam, thence to Cologn, and at last settled at Mentz, as at an asylum of security, where he might go to work with the tools he had stolen. It is certain, that in a year's time, viz. in 1442, a grammar much used at that time, together with the tracts of *Peter* of Spain, came forth there, from the same types as *Laurentius* had made use of at Haerleim."

Some authors relate that *Faustus* having printed off a considerable number of copies of the Bible, to imitate those which were commonly sold in MS. *Fuſt* undertook the sale of them at Paris, where the art of printing was then unknown. As he sold his printed copies for sixty crowns, while the scribes demanded five hundred, this created universal astonishment; but when he produced copies as fast as they were wanted, and lowered the price to thirty crowns, all Paris was agitated. The uniformity of the copies increased the wonder; infor-

mations were given into the police against him as a magician ; his lodgings were searched ; and a great number of copies being found, they were seized ; the red ink with which they were embellished was said to be his blood ; it was seriously adjudged that he was in league with the devil ; and if he had not fled, most probably he would have shared the fate of those, whom ignorant and superstitious judges condemned, in those days, for witchcraft ; from thence arose the origin of the story of the Devil and Dr. *Faustus*.

The letters were at first *wooden*, and are said to be afterwards exchanged for *metal* types ; from which the wine-pots were formed, remaining in the time of *Junius*. According to tradition, printing was carried on in the same house long after the time of *Laurentius* ; those pots might therefore be formed from the waste metal of the printing-house, after the use of fusile types became universal. But *Laurentius* seems to have carried the art no farther than separate wooden types. What is a remarkable confirmation of this, *Henry Spiechel*, who wrote in the sixteenth century, a Dutch poem intitled *Hertspiegel*, expresses himself thus : "Thou first, *Laurentius*, to supply the defect of wooden tablets, adaptedst wooden types, and afterwards did connect them with a thread, to imitate writing. A treacherous servant surreptitiously obtained the honour of the discovery. But truth itself, though destitute of common and wide spread fame ; Truth, I say, still remains." There is no mention in the poem of *metal types* ; a circumstance which, had he been robbed of such, as well as of *wooden* ones, would scarcely have been passed over in silence. When *Laurentius* first devised his rough specimen of the art, can only be guessed at. He died in 1440, after having published the *Speculum Belgicum*, and two editions of *Donatus*, all with different wooden types : which it is probable (considering the difficulties he had to encounter, and the many artists whom he must necessarily have had occasion to consult) cost him some years to execute ; so that the first essay might be about 1430.

Some of *Laurentius*'s types were stolen from him by one of his servants, *John Geinsfleisch* ; who fled there-
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with to Mentz. Having introduced the art of Harleim into this his native city, he set with all diligence to carry it on ; and published in 1442 ; two works, from which, being much used in the schools, he might reasonably expect a profitable sale. They were executed with wooden types ; cut after the model of those he had stolen. Wooden types being found not sufficiently durable, and not answering expectation in other respects, caused the first invention of *cut metal types*. But the honour of completing the discovery is due to *Peter Schoeffer de Gurnsheim*.

An ample testimony in favour of *Schoeffer* is given by *Jo. Frid. Faustus* of Aschaffenburg, from papers preserved in his family : “ *Peter Schoeffer* of Gernsheim, perceiving his master *Fust*’s design, and being himself ardently desirous to improve the art, found out (by the good providence of God) the method of cutting (*incidendi*) the characters in a matrix, that the letters might easily be singly cast, instead of being cut. He privately cut matrices for the whole alphabet : and when he showed his master the letters cast from these matrices, *Fust* was so pleased with the contrivance, that he promised *Peter* to give him his only daughter, *Christina*, in marriage ; a promise which he soon after performed. But there were as many difficulties at first with these letters, as there had been before with wooden ones ; the metal being too soft to support the force of the impression : but this defect was soon remedied, by mixing the metal with a substance that sufficiently hardened it.” *Fust* and *Schoeffer* concealed this new improvement by administering an oath of secrecy to all whom they entrusted, till the year 1462 ; when, by the dispersion of their servants into different countries, at the sacking of Mentz by the Archbishop *Adolphus*, the invention was publicly divulged.

Printing made a rapid progress in most of the principal towns in Europe. In 1490 it reached Constantinople ; and, according to Mr. *Palmer*, it was extended, by the middle of the next century, to Africa and America. It was introduced into Russia about 1560 : but, from motives either of policy or superstition, it was speedily suppressed by the ruling powers ; and, even under

under the present enlightened empress, has scarcely emerged from its obscurity. That it was early practised in the inhospitable regions of Iceland, we have the respectable authority of Mr. Bryant.

Introduction of Printing into Britain.—It was a constant opinion, delivered down by our historians, as hath been observed by Dr. Middleton, that the Art of Printing was introduced and first practised in England by *William Caxton*, a mercer and citizen of London; who, by his travels abroad, and a residence of many years in Holland, Flanders, and Germany, in the affairs of trade, had an opportunity of informing himself of the whole method and process of the art; and by the encouragement of the great, particularly of the abbot of Westminster, first set up a press in that abbey, and began to print books soon after the year 1471. This was the tradition of our writers, till a book, which had scarce been observed before the restoration, was then taken notice of by the curious, with a date of its impression, from Oxford, anno 1468, and was considered immediately as a clear proof and monument of the exercise of printing in that University several years before *Caxton* began to deal in it.

This book, which is in the public library at Cambridge, is a small volume of forty-one leaves in quarto. The appearance of this book has robbed *Caxton* of a glory that he had long possessed, of being the author of printing to this kingdom; and Oxford ever since carried the honour of the first press. The only difficulty was, to account for the silence of history in an event so memorable, and the want of any memorial in the University itself, concerning the establishment of a new art amongst them, of such use and benefit to learning. But this likewise has been cleared up, by the discovery of a record, which had lain obscure and unknown at Lambeth-house, in the Register of the See of Canterbury; and gives a narrative of the whole transaction, drawn up at the very time.

It sets forth, "That as soon as the art of printing made some noise in Europe, *Thomas Bourchier*, archbishop of Canterbury, moved the then King (*Henry VI.*) to use all possible means for procuring a printing-mould

mould (for so it was then called) to be brought into this kingdom. The King readily hearkened to the motion; and taking private advice how to effect his design, concluded it could not be brought about without great secrecy, and a considerable sum of money, given to such person or persons as would draw off some of the workmen of Harleim in Holland, where *John Guthenburg* had newly invented it, and was himself personally at work. It was resolved, that less than 1000 merks would not produce the desired effect; towards which sum the said archbishop presented the king 300 merks. The money being now prepared, the management of the design was committed to Mr. *Robert Turnour*; who then was master of the robes to the king, and a person most in favour with him of any of his condition. Mr. *Turnour* took to his assistance Mr. *Caxton*, a citizen of good abilities, who traded much into Holland; which was a creditable pretence, as well for his going, as stay in the Low-countries. Mr. *Turnour* was in disguise (his beard and hair shaven quite off); but Mr. *Caxton* appeared known and public. They having received the said sum of 1000 merks, went first to Amsterdam, then to Leyden, not daring to enter Harleim itself; for the town was very jealous, having imprisoned and apprehended divers persons come from other parts for the same purpose. They staid till they had spent the whole thousand merks in gifts and expences; so as the king was fain to send 500 merks more, Mr. *Turnour* having written to the king that he had almost done his work; a bargain (as he said) being struck betwixt him and two Hollanders, for bringing off one of the under workmen, whose name was *Frederick Corfells* (or rather *Corfellis*), who late one night stole from his fellows in disguise, into a vessel prepared for that purpose: and so, the wind favouring the design, brought him safe to London. It was not thought so prudent to set him on work at London: but, by the archbishop's means, *Corfellis* was carried with a guard to Oxon; which guard constantly watched to prevent *Corfellis* from any possible escape, till he had made good his promise in teaching them how to print. So that at Oxford print-

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ing was first set up in England, which was before there was any printing-press or printer in France, Spain, Italy, or Germany (except the city of Mentz), which claims seniority, as to printing, even of Harleim itself, calling her city, *Urbem Moguntinam artis typographicae inventricem primam*, though it be known to be otherwise; that city gaining the art by the brother of one of the workmen of Harleim, who had learnt it at home of his brother, and after set up for himself at Mentz. This press at Oxon was at least ten years before there was any printing in Europe, except at Harleim and Mentz, where it was but new-born. This press at Oxford was afterwards found inconvenient to be the sole printing-place of England; as being too far from London and the sea. Wherefore the king set up a press at St. Alban's, and another in the city of Westminster, where they printed several books of divinity and physic. By this means, at length, the art grew famous.

From the authority of this record, all our late writers declare *Corfellis* to be the first printer in England. But this does not derogate from the honour of *Caxton*, who was the first in England that used *fusile Types*; and consequently the first that brought it to perfection; whereas *Corfellis* printed with separate cut types in wood, being the only method which he had learned at Harleim. *Caxton's* printing office was in the abbey of Westminster: he pursued his business with extraordinary diligence till 1494, in which he died very old.

As to the *method of printing*, we shall only observe that the types, or letters, are distributed each kind by itself, in cases. The compositor placing the copy of the work before him, picks up letter by letter and arranges them in order to form words, and sentences, till he has composed a page, and so on for the whole work; the degree of expedition and dispatch with which this is carried on is not easily to be conceived. When a certain number of pages are completed, they are firmly placed in due order in a chace, which is a rectangular iron frame. In this condition the work is called a *form*; and the next thing is to work it off at the *printing-press*. This *press* is a very complex machine; its two principal parts are, the body of the press, which

which serves to give the weight or stroke for the impression; and the carriage on which the form is laid to undergo the same. The ink used in printing, is composed of nut or linseed oil, boiled and purified with bread and onions: with this oil is mixed boiled turpentine, which makes a kind of varnish, and this is worked up with a quantity of lamp-black. For red ink they use vermilion instead of lamp-black.

Chinese Printing.—As to the antiquity of it, there are three opinions, one fixing it to 300 years before Christ, another 900 years after him, and the third, carrying it still farther back, and making it coeval with that mighty empire. This last is the least probable. Their manner of printing is very different from that which now obtains among the Europeans. It has, it is true some advantage over ours in correctness, and the beauty of the character, but in other respects it comes far short.

Books are printed in China from wooden planks, or blocks cut like those used in printing of calico, paper, &c. among us. Those blocks are made of a smooth firm wood, and of the size of the leaf required, upon the face side, some able penman draws out the several letters with a kind of pencil; when finished, the block is cut by the sculptor, with his sharp small instruments which makes all the characters appear in relieve on the wood.

Their paper is inferior to ours. It is made of the inner bark or rind of a kind of rushes, beat up with water, into a pulp or paste, and formed into moulds, much like ours. The advantage of the Chinese printing consists in this, they are not obliged to take off the whole edition at once, but print their books as they need them. Their blocks are easily retouched and made to serve again; and there needs no corrector of the press.

Its disadvantages are that a large room will scarcely hold all the blocks of a moderate volume, that the colour of their ink easily fades, that their paper is apt to tear, and is subject to worms, whence it is that we see so few ancient books in China.

Rolling-press printing, is employed in taking off prints, or impressions from copper-plates engraven or etched ; an account of which shall appear under the article engraving.

POTTERY.

POTTERY, is the art of making earthen pots or vessels ; or the manufactory of earthen ware. The clay used for this purpose is a soft viscous earth of different kinds and properties ; and may be found in various places. Dr. *Lister*, in the *Phil. Transf.* gives us a table of twenty two several sorts of clays, found in the several counties of England ; five of which he calls pure, that is, such as are soft, like butter to the teeth with little or no grittiness in them. Those esteemed impure are either of a sandy or stony nature, chalky or dusty, &c.

Among the instruments used in pottery, the wheel and the lathe, are the chief ; the first for large works, the second for small.

The potters wheel consists principally in its nut, which is its beam or axis, whose pivot plays perpendicularly on a free-stone sole at bottom. From the four corners a-top of this beam, arise four iron bars called spokes, which forming diagonal lines with the beam descend, and are fastened at bottom to a strong wooden circle. The top of the nut is flat of a circular figure, and a foot in diameter. On this is laid a piece of the clay or earth to be turned and fashioned. The wheel thus disposed, is encompassed with four sides of four different pieces of wood, sustained on a wooden frame. The hind piece which is that whereon the workman sits, is made a little inclining towards the wheel. On the fore piece are placed the pieces of prepared earth ; by his side is a trough of water, wherewith from time to time he wets his hands, to prevent the earth's sticking to them.

The potter having prepared his clay or earth, and laid a piece of it suitable to the work he intends on the

the top of the beam, turns the wheel, till it has got the proper velocity; forming the cavity of the vessel, and widening it till it has received its intended form. When the vessel is found to be too thick, they pare off what is redundant with an instrument. When the vessel is finished they take it off from the circular head by a wire passed underneath the vessel.

The *potter's lathe* is also a kind of wheel, but simpler and slighter than the former. Its three chief members are, an iron beam, or axis placed perpendicularly; a little wooden wheel, an inch thick, and six or eight inches in diameter, placed horizontally a-top of the beam; and serving to form the vessel on; and the third part is a thick wooden wheel, placed horizontally at bottom.

The workmen work with the lathe, with the same instruments, and after the same manner as the wheel. The lathe and wheel serve only to give the form of the body of the vessel; the feet, handles, and other occasional ornaments, are made and set by the hand. If there be any sculpture in the work, it is usually done in earthen or wooden moulds, prepared by a sculptor; unless the potter have skill enough to do it himself, which is very rare.

As to the glazing and varnishing of the work, it is usually done with mineral lead, i. e. lead pulverized by throwing charcoal-dust into the melted lead, and the ashes of lead: which, in effect, are only its scum and scoria.

BRICKS.

BRICKS, appear to be of a very ancient standing; the tower of Babel and the walls of Babylon being built thereof. Under the first kings of Rome, they built with massive squared stones, which they learned from the Tuscans; but towards the latter time of the republic, they began to use brick; borrowing the practice from the Greeks. The greatest and the most durable buildings of the succeeding Emperors, as the pantheon, &c. were built therewith.

In the east, they baked their bricks in the sun ; and the Romans used them crude ; only leaving them to dry in the air for four or five years.

Barbaro, in his commentary on *Vitruvius*, recommends a singular form of bricks ; viz. triangular ones, every side a foot long, and only an inch and half thick. These he observes, would have many conveniencies ; and *Sir. H. Wotton*, wonders they have never been taken into use, being recommended by so great an authority.

Brick, is a fat reddish earth, formed into long squares, four inches broad, and eight or nine inches long, by means of a wooden mould, and then baked or burnt in a kiln, to serve the purposes of building.

The first step in the process of brick-making, is casting the clay, or earth. The next step is to tread or temper it ; this ought to be done doubly of what is usually done ; since the goodness of bricks depend chiefly upon this first preparation. The earth itself before it is wrought is generally brittle and dusty ; but adding small quantities of water gradually to it, and working and incorporating it together, the whole becomes of a gluey substance.

They are commonly of a red colour, though there are some in *Walpit* in *Suffolk*, that are white. Bricks may be made of any earth that is clear of stones. but all will not burn red. According to *Leibourn* the earth ought to be dug before winter, but not made into bricks before spring.

Stourbridge clay, and *Windsor* loam, are esteemed the best for making of such bricks as will stand the fiercest fires.

Bricks are burnt either in a kiln or clamp. Those that are burnt in a kiln, are first set or placed in it and then the kiln being covered with pieces of bricks they put in some wood to dry them with a gentle fire, and this they continue till the bricks are pretty dry, which is known by the smokes turning from a darkish colour ; to a transparent smoke. Then they leave off putting in wood, and proceed to make ready for burning, which is performed by putting in brush, furze, spray,

spray, heath, break, or fern faggots ; but before they put in these, they dam up the mouth of the kiln with pieces of brick, piled up one upon another, and close it up with wet brick-earth instead of mortar ; leaving but just room above it to thrust in a faggot, then adding more till the kiln and its arches look white, and the fire appears at the top of the kiln ; upon which they slacken the fire ; and this they do alternately heating and slacking, till the ware be thoroughly burnt, which in some places is effected in forty-eight hours.

About London they chiefly burn them in *Clamps*; built of the bricks themselves, after the manner of arches in kilns, with a vacancy between each brick for the fire to play through : but with this difference, they span it over by making the bricks project one over another on both sides of the place, for the wood and coals to lie in till they meet, and are bounded by the bricks at the top, which close all up. The place for the fuel is carried up straight on both sides, till about three feet high ; then they almost fill it with wood, and over that lay a covering of sea-coal. But they strew sea-coal also over the clamp, betwixt all the rows of bricks ; lastly they kindle the wood, which gives fire to the coal ; and when all is consumed, then they conclude the bricks are sufficiently burnt.

Dr. *Percival*, in his essays, proves by an experiment upon bricks that the practice of lining wells with bricks is a very unwholesome one.

TYLE, or Tile ; a thin factitious stone used in the roofs of houses ; or more properly a fat clayey earth moulded into a certain form, and dried and burnt like bricks.

Tyles are made of better earth than brick-earth, and something of the same kind with potters earth. According to a statute of Edward IV. the earth for tyles should be cast up before the first of November, and not made into bricks before March. The method of burning is similar to brick. There are various kinds of tyles for the various kinds of building.

The Dutch Tyles ; or as they are sometimes called *Flemish tyles*, are of two kinds, ancient and modern. The *ancient* for chimney foot-pieces ; they were painted with antic figures and morefque devices, but came short, both as to the design and colouring of the modern ones. The more *modern* Dutch tyles, are commonly used plaistered up in the jaumbs of chimnies, and are much better glazed and painted than the former kind. Both these seem to be made of the same white clay as our glazed earthen ware.

Tuileric, Tylery, a tyle-work, implies a large building with a drying place, covered a-top, but furnished with apertures on all sides, through which the wind having admittance, dries the tyles, bricks, &c.

The garden of the Louvre was called the *Tuileries*, as being a place where bricks were anciently made ; a magnificent palace was afterwards begun there in 1564, by Catharine de Medicis, wife of Henry II. and finished by Henry IV. and was magnificently adorned by Louis XIV.

PIPES.

PIPE is a well known machine, used in the smoking of tobacco, consisting of a long slender tube made of earth or clay. There are various fashions, long, short, plain, worked, white, varnished, unvarnished, of various colours, &c. The Turks use pipes three or four feet long, made of rushes, or of wood bored ; at the end whereof they fix a kind of nut of baked earth, which serves as a bowl, and which they take off, after smoking.

The clay with which our pipes are made, is dug up in several parts of England ; as at Pool in Dorsetshire, Bideford in Devonshire, &c. It is brought to the makers in clumps of six or eight inches square. Before they moisten it for use, it is laid to dry, because, they say it works the better. When it is used, it is thrown into a large pan, moistened with water, and beaten and moulded till it be soft and mellow, and
exceedingly

exceedingly well tempered. From thence it is removed to the rolling board, where the workman readily breaks off an exact quantity for a couple of pipes rolls out both at once, one in each hand, to the proper length and form, leaving a sufficient quantity at one end for the bowl. They are in this state laid on a board by dozens. Here they lie till they have acquired a greater degree of hardness. The next step is the forming of the tube, which is dexterously done by running up a wire through the clay. The pipe is in this state, closed in a mould of polished iron, and now by the help of another machine the bowl instantly receives its form, and the whole pipe is returned in its exact figure. It is now again left to harden yet more before it undergoes its last smoothing and finish, which is quickly done by a kind of knife, &c. and from thence it is taken to the kiln.

Kilns are of various sizes : some hold twenty gross ; others eighty, and even a hundred ; but the more usual size contains forty or fifty gross of pipes. Here they are six or eight hours, exposed to a strong, clear fire. This brings them to their state of whiteness ; and is the last operation. From hence they are taken and packed up in boxes for sale. Great quantities are exported from England to foreign countries. Workmen say the blackest clay burns the clearest, and makes the whitest pipes. The wholesale price varies ; from sixteen to thirty pence per gross ; some kinds are higher.

This article of manufacture is carried on in many cities and places in England ; as London, Bristol, Norwich, Hull, Liverpool. Not so many houses carry on this business, as formerly. The reasons assigned may be that the smoking of tobacco is not so frequent in the higher circles as when first introduced, and one workman will now from his acquired dexterity, manufacture more goods than when the invention was less known.

PORCELAIN.

PORCELAIN, or Purcelain ; a fine sort of earthenware, chiefly manufactured in China, and thence also called china, or china-ware ; but brought into Europe from other parts of the east, especially Japan, Siam, Surat, and Persia.

The Chinese call it *Tse-ki*. The word Porcelain is but little known there, except among a few workmen and merchants ; and seems derived from the Portuguese, *Porcelena*, a cup.

Scaliger and *Carden* though generally of contrary sentiments, are yet agreed, that what the Romans called *Vasa Murrhina*, *Murrina* and *Murrea*, which were first seen at Rome in *Pompey's* triumph, and afterwards became so very precious, were the porcelain of our times.

This may be true : but if the opinion be only founded on *Pliny's* description of those vessels, one would rather take them for a kind of precious stones, of a whitish colour, but variously veined and variegated ; found in some parts of Parthia.

Be this as it will, it is certain, that both *Cardan* and *Scaliger* are mistaken when they tell us that porcelain is made of eggs and sea-shells beaten small, and buried under ground for 80 or 100 years. The account we shall here give will put that matter out of all question.

It is not known who was the inventor of porcelain : the Chinese annals, which use to contain every thing in any wise memorable, are perfectly silent about it ; nor do we know much more of the time of its invention ; only it is certain it must have been before the beginning of the fifth century, the annals of *Feuilang* relating, that from the second year of the reign of the Emperor Tam, about the year of Christ 442, the workers in porcelain of that province had alone furnished the Emperors therewith.

Porcelain is made chiefly, some say wholly, at Kingteching. There is some indeed made in the provinces of Kanton and Fokyen ; but it is of little account, being far inferior in beauty and value to the porcelain of Kingteching. That of Fokyen is perfectly white,
without

without either gloss or painting. Attempts have been made to remove the manufacture from Kingteching to Peking, and other places but in vain: the porcelain made in the new manufactories never coming up to that of the old; so that Kingteching has the honour of supplying the greatest part of the world with this commodity. *F. du Halde* assures us that even the Japanese come to China for it.

Manufacture of Porcelain.—Porcelain makes a very curious article in commerce, and even natural history. Its manufacture formerly passed for a mystery in Europe; and that in spite of all the Jesuit missionaries have done to penetrate into the secret. In a letter of *F. d'Entrecolles* to *F. Orry*, the whole process is described.

In the manufacture of porcelain there are four principal things; the matter it is made of; the art of forming the vessels, and other works; the colours where-with it is painted: and lastly, the baking, or giving it a proper degree of fire.

Materials of Porcelain.—There are two kinds of earths, and as many kinds of oils, or varnishes, used in the composition of porcelain. The first earth, called kaulin, is beset with glittering corpuscles; the second, called petunse, is a plain white, but exceedingly fine, and soft to the touch. They are both found in quarries twenty or thirty leagues from Kingteching; and hither these earths, or rather stones, are brought in an infinite number of little barks, incessantly passing up and down the river Jauchew, for that purpose. The petunses are brought in form of bricks; having been so cut out of the quarries, where they are naturally pieces of a very hard rock. The white of the best petunse should border a little on green.

The first preparation of these bricks is, to break and pound them, first, into a coarse powder with iron mallets, then in mortars with pestles that have stone heads, armed with iron, and wrought either with the hand, or with mills.

When the powder is rendered almost impalpable, they throw it in a large urn full of water, stirring
it

it briskly about with an iron instrument. After the water has rested a little while, they skim off from the top a white substance formed there, and disposed this scum or cream in another vessel of water. They then stir again the water of the first urn, and again skim it, and thus alternately, till there remain nothing but the gravel of the petunses at bottom; which they lay afresh under the mill for a new powder. As to the second urn, wherein are put the skimmings of the first: when the water is well settled, and become quite clear, they pour it off; and with the sediment, collected at bottom in form of a paste, fill a kind of moulds: whence, when almost dry, they take it out, and cut it into square pieces, which are what they properly call *petunses*; reserving them to be mixed with the kaulin in the proportion hereafter assigned.

The *kaulin*, which is the other earth used in porcelain, is much softer than the petunse, when dug out of the quarry; yet it is this, which, by its mixture with the other, gives the strength and firmness to the work.

The mountains whence the kaulin is dug, are covered without side with a reddish earth. The mines are deep, and the matter is found in glebes, or clods, like the chalk in ours.

The oil or varnish, which makes the third ingredient in porcelain, is a whitish, liquid substance, drawn from the hard stone whereof the petunses are formed; that which is whitest, and whose stains are the greenest, being always chosen for this purpose.

The oil of lime makes the fourth ingredient.

Forming of Porcelain Vessels.—The first thing is, to purify the earths, petunie and kaulin; which, for the first, is done after the manner already described in preparing the squares. For the second, as its softness makes it dissolve easily, it is sufficient, without breaking it, to plunge it in an urn full of water in an open basket. The dregs that remain, are perfectly useless.

The work-houles are properly vast yards walled round, with sheds, and other conveniences for the workmen to work under, as well as other buildings for them to live in: It is almost inconceivable what number of persons are employed in these works; there being

being scarce a piece of porcelain but passes through above twenty hands, before it comes to the painter's workhouse; and above sixty, before it be brought to perfection.

To make a just mixture of petunse and kaulin, regard must be had to the fineness of the porcelain to be made: For the finer porcelains, they use equal quantities; four parts of kaulin to six of petunse, for moderate ones; and never less than one of kaulin to three of petunse, for the coarsest.

The hardest part of the work is the kneading the two earths together; which is done in a kind of large basons, or pits, well paved and cemented, wherein the workmen trample continually with their feet, relieving one another, till the mass be well mixed, grows hard, and becomes of the consistence required to be used by the potter.

The earth, when taken out of the basons, is kneaded a second time, but piece-meal, and with the hands, on large slates for the purpose; and on this preparation, in effect, it is, that the perfection of the work depends.

The porcelain is fashioned or formed either with the wheel, like earthen-ware; or in moulds. Smooth pieces, as cups, urns, dishes, &c. are made with the wheel. The rest, *i. e.* such as are in relievo, as figures of men, animals, &c. are formed in moulds, but finished with the chissel. The large pieces are made at twice; one half of the piece is raised on the wheel by three or four workmen, who hold it till it have acquired its figure; which done, they apply it to the other half, which has been formed in the same manner; uniting the two with porcelain-earth, made liquid by adding water to it. After the same manner it is that they join the several pieces of porcelain formed in moulds, or by the hand; and after the same manner they add handles, &c. to the cups and other works formed with the wheel.

The moulds are made after the manner of those of our sculptors, *viz.* of divers pieces which severally give their respective figure to the several parts of the model to be represented; and which are afterwards united to form a mould for an intire figure.

To

To conceive the number of hands each piece of porcelain passes through ere perfect, we shall close this article with what *F. d'Entercolles* instances of a common tea-cup, before it be fit for the painter : The cup begins with the potter, who has the management of the wheel, where it acquires its form, height, and diameter. This operator has not a farthing sterling for a plate furnished with twenty-six cups ; accordingly, they go out of his hands exceedingly imperfect, especially towards the feet, which are only unformed lumps of earth, to be afterwards cut with the chissel, when the cup is dry. When it comes from the wheel, the cup is received by a second workman, who fits it for its base. A third takes it immediately from him, and applies it on a mould to bring it to its true form. This mould is on a kind of lathe. A fourth workman polishes the cup with a chissel, especially about the edges ; and brings it to the thinness necessary to make it transparent ; in doing which, he moistens it from time to time, lest its dryness should make it break. When of its proper thickness, another workman turns it gently on a mould, to smooth its inside ; taking a deal of care it be done equally, lest any cavity be formed, or it warp. Other workmen add some ornaments in relievo ; others, impressions in creux ; others, only handles, as the quality of the cup requires. At last, they round and hollow the foot on the inside with a chissel ; which is the function of a particular artist, who does nothing else.

It is found by experience that this multiplicity of workmen, so far from retarding the work, causes it to go on the faster, as well as to be the better done ; each workman, by a continual attention to the same thing, becoming very dextrous at it : besides saving the time of changing instruments, &c.

Painting of Porcelain.—The Chinese painters, especially those that meddle with human figures, our author observes, are all sorry workmen. But it is otherwise with the colours they use ; which are so exceeding lively and brilliant, that there are but little hopes that our workmen will ever excel them.

The painting work is distributed among a great number of workmen, in the same laboratory: to one it belongs to form the coloured circle about the edges of the porcelain; another traces out flowers, which another paints: this is for waters and mountains alone: that for birds and other animals; and a third for human figures.

The gold is not applied till after the baking, and is rebaked in an oven for the purpose: to apply the gold, they break and dissolve it in water at the bottom of a porcelain, till a thin gilded cloud arise on the surface; it is used with gum-water.

The several kinds of porcelains, being quite painted, with their several colours, and all the colours dry, are to be *polished*, to prepare them to receive the oil or varnish; which is done with a pencil of very fine feathers, moistened with water, and passed lightly over, to take off even the smallest inequalities.

The *oiling* or *varnishing* is the last preparation of the porcelain, before it be carried to the oven: this is applied more or less thick, and seldomer or oftener repeated, according to the quality of the work. For thin, fine porcelains, they give two very thin couches; to others one; but that one equivalent to the other two. There is a deal of art in applying the varnish; both that it be done equally, and not in too great a quantity.

Our curious author says he has been frequently surprized, to see a man pass through several streets full of people, with two very long, narrow boards, ranged with porcelains on his shoulders; still preserving the equilibrium so accurately, as not to do any damage to so frail a commodity.

Baking or nealing of Porcelain.—There are two kinds of ovens used in baking of porcelain: large ones, for works that are only to come to the fire once, which is the common way; and small ones for such as require a double baking.

The French have been these fifty years attempting to imitate *porcelain*. The first essays at Rouen succeeded tolerably well; and M. Savary has spoken much in praise of the manufactories of Passy and St. Cloud.

Cloud. Of the English porcelains, and particularly that manufactured in the city of Worcester, it may be said that they want little or nothing to make them of equal value with the Chinese, but to be brought five or six thousand leagues. In effect, for the fineness of the grain of the matter, the beauty and turn of the vessels, the exactitude of the design, and the lustre of the colours, &c. these works have been for many years in high repute, and are every day gaining greater estimation. And in justice to the manufactory, the writer observes, that in different parts of the kingdom he has found well informed people so far unacquainted with it, as to believe the Delft or Staffordshire ware, the only Worcester China; nor could they be persuaded to think that what was really the produce of that manufacture was any other than real china ware, or at least some foreign porcelain.—*Pollnitz* assures us that the Saxons produce porcelains painted and enamelled in great perfection.

GLASS.

GLASS, a brittle, transparent, factitious body, produced by the action of fire, from salt and sand or stone.

The chymists hold that there is no body but may be *vitrified*, i. e. converted into glass. By intense heat, even gold itself, gives way to the sun's rays collected in a burning-glass, and becomes *glass*. As glass is the effect or fruit of fire, so it is the last effect, all the chymists art, and all the force of fire not being able to carry the change of any natural body beyond its vitrification. Whence *Dr. Merret* mentions it as a merry saying of a great artist in the business of glass, that their profession would be the last in the world. For that when God should consume the universe with fire, all things therein should be turned to glass.

Many are the qualities of glass.—When red hot it is ductile, and may be fashioned into any form—neither acid juices, nor any other matter, extract either colour, taste, or any other quality from it. It loses nothing of its

its weight or substance by the longest use. It is the most pliable thing in the world, and best retains the fashion given it; no liquor whatever will change its colour, it is capable of being graven or cut with only diamond and emery. A drinking glass, partly filled with water and rubbed on the brim with a wet finger, yields musical notes, higher or lower, as the glass is more or less full, and makes the liquor frisk and leap.

Origin and history of Glass.—*De Neri* will have glass as ancient as *Job*: for that writer speaking of wisdom, says, gold and glass shall not be equalled to it.

This, we are to observe, is the reading of the Septuagint, vulgate Latin, *St. Jerom*, &c. For in the English version, instead of *glass*, we read *crystal*; for the word signifying beautiful and transparent in the general, the translators were at liberty to apply it to whatever was valuable and transparent.

Most authors will have *Aristophanes* to be the first author who mentions glass.

Aristotle has two problems upon glass; the first, why we see through it? the second, why it cannot be beaten?

After him the word occurs often enough: *Lucian* mentions large drinking glasses: and *Plutarch* says that the fire of tamarisk wood is the fittest for making of glass.

Among the Latin writers, *Lucretius* is the first that takes notice of glass.—*Nisi recta foramina tranant. Qualia sunt vitri.*

Dr. Merret, however, adds, that glass could not be unknown to the ancients; but that it must needs be as ancient as pottery itself, or the art of making bricks; for scarcely can a kiln of bricks be burnt, or a batch of pottery ware be made, but some of the bricks and ware will be at least superficially turned to glass; and therefore, without doubt, it was known at the building of Babel.

Glass was found, according to *Pliny*, by accident in Syria, at the mouth of the river Belus, by certain merchants driven thither by fortune of the sea. Being obliged to live there, and dress their victuals, by making a fire on the ground; and there being store of the plant kali upon the spot: this herb being burnt to ashes, and

the sand or stones of the place, accidentally mixed with it, a vitrification was undesignedly made, from whence the hint was taken, and easily improved.

Indeed, how old soever glass may be; the art of making and working it, appears of no great antiquity.—The first place mentioned for making hereof, is Sidon in Syria, which was famous for glass and glass-houses, as observed by *Pliny*. The first time we hear of glass made among the Romans, was in the time of *Tiberius*; when *Pliny* relates that an artist had his house demolished for making glass malleable, or rather flexible.—Though *Petronius Arbiter* relates, that the Emperor ordered the artist to be beheaded for his invention.

Venice, for many years, excelled all Europe for the fineness of its glasses. The great glass-works at Muran, a village near the city; which furnished all Europe with finest and largest glasses. But within this fifty years the French and English, have not only come up to, but even surpassed the Venetians; so that we are now no longer supplied from abroad.

The French made a considerable improvement in the art of glass, by the invention of a method to cast very large plates, till then unknown, and scarce practised yet, by any but themselves and the English.

Ingredients of Glass.—The materials used in the composition of glass, we have observed, are salt, and sand, or stone.

The salt is of the fixt kind; such as will not evaporate by the most intense heat. The sand or stone, must be such as will melt easily; this is what gives firmness and consistence to the glass.

1° This salt is procured chiefly from a kind of ashes, brought from the Levant, and particularly from Alexandria and Tripoli. The ashes are those of a vegetable, frequent in this country, commonly called *kali*; *Dr. Merret* calls it *English salt-wort*, from its saline taste; and *glass-weed* from the use made of its ashes in making of glass.

Bauhin mentions ten species of this plant; the first and last, our own coasts afford, where they are called by the people *frog-grass* and *sea-grass*, but they are of no use for making of glass: being laid on a hot iron, they

they fly off almost wholly in fumes, leaving no ashes at all; whereas the kali's brought from the Levant, applied on the same iron, are soon converted almost wholly into *polverine*, i. e. very saline ashes, of a dark colour.

To get the salt from this *polverine*, they pulverize and sift it very fine; then boil it in a copper, with fair water and tartar, till a third part of the water is consumed; then filling up the copper with fresh water, they boil it a second time, till half be consumed; this done, they have a lee impregnated with salt. To get the salt from the lees, they boil them, till the salt shoots at the top; which they scum off as it rises. An hundred pounds of ashes this way, usually yields eighty or ninety of salt.

When the salt is dry, they beat it grossly, and put it into a furnace, to dry it further with a gentle heat.—When sufficiently dry, they pound and sift it very fine, and lay it by to make frit.

Note, instead of the ashes of the plant kali, those of fern will also yield a salt, which makes excellent glass; nothing inferior to that of *polverine*. The method of preparation is the same. Add, that ashes of stalks of beans; as also those of coleworts, bramble bush, millet stalks, rushes, fern rushes, and many other plants may be used for the like purpose, and after the same manner.

2^o For *stone*, the second ingredient in glass.—The best, we have observed, is that which will melt, is white and transparent. This is found principally in Italy, being a sort of marble, called *tarso*: the next is a sort of pebbles found at the bottom of rivers.

Indeed, nothing makes finer and clearer glass than flint, but the charge of preparing it, deters the glassmen from using it. The preparation necessary for stone, is to calcine, powder, and sift.

Ant. Neri observes, that all white transparent stones, which will not turn to lime, are fit to make glass; and that all stones which will strike fire with steel, are capable of being employed in making of glass. But this latter rule, *Dr. Merret* observes, does not hold universally.

Where proper stone cannot be had, sand is used; the best for the purpose is that which is white and small; for green glais, that which is harder and more gritty; it is to be well washed; which is all the preparation it needs. Our glais-houses are furnished, with white sand for their crystal glasses from Maidstone; and with the coarser, for green glais, from Woolwich.

Some mention a third ingredient in glais, viz. Manganese, or sydereas, a kind of pseudo load-stone, dug up in Germany, Italy, and even in Mendip-hills in Somersetshire. But the proportion hereof to the rest is very inconsiderable; beside that it is not used in all glais. Its office is to purge off the natural greenish colour, and give it some other tincture required.

Method of making white or crystal glais.—There are three sorts of furnaces used in the glais-works: one to prepare the frit, a second to work the glais, and a third to anneal it.

To make crystal glais, take of the whitest tarso pounded small and sifted as fine as flour, two hundred pounds; and salt of polverine, an hundred and thirty pounds. Mix them together, and put them into a furnace called calcar, first beating it. For an hour keep a moderate fire, and keep stirring the materials, that they may incorporate and calcine together. Then increase the fire for several hours: after which take out the matter, which being now sufficiently calcined, is called frit. From the calcar put the frit in a dry place, and cover it up from the dust, for some months.

Now, to make the glais, or crystal: take of this crystal frit, set in pots in the furnace, adding to it a due quantity of manganese; when the two are fused, cast the flour into fair water, to clear it of the salt, called *sandever*, which would otherwise make the crystal obscure and cloudy. This must be repeated as often as needful till the crystal be fully purged. Then set it to boil some days; which done, see whether it have manganese enough; and if it be yet greenish, add more manganese at discretion. Then let the metal clarify till it become of a clear and shining colour: which done, it is fit to be blown, or formed into vessels at pleasure.

There

There are three principal kinds of glasses, distinguished by the form or manner of working them, viz. round glass, as those of our vessels, phials, drinking glasses, &c. table or window glass, of which there are divers kinds, viz. crown glass and plate glass, or looking glass.

Working or blowing round Glass.—The working furnace, we have observed, is round, and has six boccas or apertures; at one of these called the *great bocca*, the furnace is heated, and the pots of frit set in the furnace: two other, smaller holes, serve to lade or take out the melted metal, at the end of an iron, to work the glass. At the other holes they put in pots of fusible ingredients, to be prepared, and at last emptied into the lading pot.

There are six pots in each furnace, all made of tobacco-pipe clay, proper to sustain not only the heat of the fire, but also the effect of the pulverine, which penetrates every thing else. There are only two of these pots that work: the rest serve to prepare the matter for them. The fire of the furnace is made and kept up at the six apertures. This they never omit, not even on the most solemn festivals.

When the matter contained in the two pots is sufficiently vitrified, they proceed to blow or fashion it.

The operator takes his blowing iron, which is a long hollow tube, and dipping it in the melting pot, there turns it about: the metal sticks to the iron, like some glutinous or clammy juice, much like, but more firmly, than turpentine, or Venice treacle.

When there is matter enough on the instrument, the operator begins to blow gently through the iron; by which he raises or lengthens it nearly a foot; much as we do by blowing in a bladder or globe; and to give it a polish he rolls it to and fro on a stone or marble.

This done, he blows a second time, and thus forms the bunch or belly of the glass.

Sometimes the glass thus blown round, is returned to the fire, where it flattens a little of itself; when flatted, it is taken out, and cooled; and if needful for the design the workman flats its bottom, by pressing it on the

marble; or moulds it in the stamp-irons: and thus delivers it to the master workman, to break off the neck.

The neck is the narrow part which clove to the iron; to set the glass at liberty, they lay a drop of water on the collet; which by its coldness, cuts or cracks about a quarter of an inch; after which, giving it a slight blow, the fracture is communicated all round the neck.

The vessel is afterwards returned to the great bocca; where being sufficiently heated a second time, the workman gives the bowl its finishing, by turning it about with a circular motion; which it increases, in proportion as the bowl opens, and enlarges by means of the heat and agitation.

Thus with blowing, pressing, scalding, amplifying and cutting, the glass is framed into the shape preconceived in the workman's mind.

When the master has finished a number of them, another servitor takes them with an iron fork, and speedily places them to anneal and harden.

What has been here said of white or crystal glass, holds equally of common, or green glass; the working being the same in all, and the difference only in the salt or pulverine made use of.

So many masters as there are, so many pots at the least, and so many bocca's there must be; each man having his proper station: where, says *Dr. Merret*, they receive those scorching heats falling directly into their faces, mouths and lungs; whence they are forced to work almost naked like the Cyclops, with a straw broad brimmed hat to defend their eyes from the excessive heat and light. They sit in large wide wooden chairs, to which their instruments are hung. They work several hours at a time after which they are relieved by others, so that the furnaces are never idle.

Working or blowing Window or Table Glass.---The method of making crown window glass, now practised in England, is said to have been borrowed from the French. An English glass-maker went over to work in France, on purpose to get into the secret, which when he had attained to, he returned, and set up a glass-work, wherein he far outdid the French, his teachers.

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This glass is blown much after the manner of looking-glass. Some writers, from wrong intelligence, have said, that it was run or cast in sand; but the real process is as follows.

The furnace, melting-pots, materials, and fire are the same for window, or table glass, as for round glass, and the difference in the operation only commences after the servitor has dipped his blowing-iron the fourth time in the melted metal.

The glass, then being in this condition, they blow it; but instead of rounding, or forming it into a bunch, the particular motion the workmen gives it in the directing and managing the wind, and the way of rolling it on the iron, make it extend in length two or three foot, and form a cylinder, which at first is but two inches in diameter; but which by being recommitted to the fire, and blown afresh when taken out, becomes of the extent required for the table of glass to be formed. With this circumstance however, that the side, which is fastened to the iron, goes gradually diminishing, and ends in a kind of cone or pyramid.

To render the two ends nearly of the same diameter, after adding a little glass to that opposite to the iron, they draw it out with a pair of iron pincers. Then they cut off the same end with a little water; and carrying the cylinder back to the bocca, they cut it likewise in two other places: one, eight or ten inches from the iron; and the other the whole length.

The glass cylinder thus abridged of both its extremities, is next heated on a kind of earthen table, somewhat raised in the middle, in order to promote its opening at the place where it was cut. The workman here makes use of an iron, wherewith he alternately lowers and raises the two sides of the cylinder, which now begin to open and unfold like a sheet of paper, and at length become perfectly flat. The table of glass is now in its last perfection and needs only to be heated over again, cooled on a table of copper, and hardened in the annealing furnace.

This was the method formerly used for blowing plate glass, looking glasses, &c. but the workmen, by this method, could not exceed 50 inches in length, and a proportionable

proportionable breadth, because if larger they were always found to warp. These imperfections have been remedied by the invention of *Sieur Abraham Thevart*, in France, about the year 1688, of casting or running large plates in the following manner.

The furnace for *large looking-glass plates*, is of a very large dimension environed with several ovens or annealing furnaces. The melting pots are as big as large hogheads, and contain about 2000 weight of metal. If one of them bursts in the furnace, the loss of the matter and time amounts to 250l. the heat of this furnace is so intense that a bar of iron laid at the mouth thereof becomes red hot in less than half a minute. When the furnace is red hot the materials are put in at three different times, and in twenty-four hours they are vitrified, refined, and fit for casting.

To get the cisterns, with the metal out of the furnace, they use a large iron chain, and by the assistance of pulleys the cisterns are raised upon a kind of carriage, and conducted to the table where the glass is to be run. Here slipping off the bottom of the cistern, there rushes out a torrent of matter, all on fire, wherewith the table is presently covered. This table, whereon the glass is to be run is of pot metal, and several feet broad and long. To form the thickness of the glass, there is a kind of roller which drives the liquid matter to the end of the table. In about a minute the glass comes to a consistence, and it is then removed to the annealing furnace.

The glass now requires to be *ground and polished*; to grind it, they lay it horizontally upon a flat stone table made of a very fine grained free-stone; then taking a smaller piece of rough glass, and fastening it to a heavy wooden plank, the workmen continue to rub one glass backwards and forwards upon another till they acquire a great degree of smoothness. While they are thus employed they pour in water and sand, then a finer sort of sand, and lastly powder of flint. When the grinder has done his part, by bringing the glass to an exact plainness, it is turned over to the polisher, who with the fine powder of Tripoli stone, or emery, brings it to a perfect evenness and lustre.

PINS.

PINS.

PIN; is an article well known. For the method of making, we give the following account from *Ellis's Campagna*. When the brass wire is received at the manufactory, the first operation is winding it off from one wheel to another, and causing it to pass through a circle in a piece of iron of a smaller diameter. When reduced to its proper dimensions, it is straitened by drawing it between iron pins, fixed in a board, in a zigzag manner; afterwards it is cut into lengths of three or four yards; and then into smaller ones, every length being sufficient for six pins, each end of these is ground to a point, which was performed, when I viewed the manufactory, by boys, who sat each with two small grind-stones before him turned by a wheel. Taking up a handful, he applies the coarsest of the two stones, moving the wires round between his fingers, so that the points may not become flat: he then gives them a smoother and sharper point on the other stone, and by these means a lad of twelve or fourteen years of age, is enabled to point about 16 000 pins in an hour. When the wire is thus pointed, a pin is taken off from each end, and this is repeated till it is cut into six pieces. The next operation is that of forming the heads, or as they term it *head-spinning*, which is done by means of a spinning-wheel: one piece of wire being thus with astonishing rapidity wound round another, and the interior one being drawn out, leaves a hollow tube between the circumvolutions: it is then cut with shears; every two circumvolutions or turns of the wire forming one head: these are softened by throwing them into iron pans, and placing them in a furnace till they are red hot. As soon as they are cold, they are distributed to children, who sit with anvils and hammers before them, which they work with their feet, by means of a lathe, and taking up one of the lengths, they thrust the blunt end into a quantity of the heads which lie before them, and catching one at the extremity, they apply them immediately to the anvil and hammer, and by a motion or two of the foot, the point and the head are fixed together

together in much less time than can be described ; and with a dexterity that can only be acquired by practice ; the spectator being in continual apprehension for the safety of their fingers ends. The pin is now finished as to its form, but still it is merely brass ; it is therefore thrown into a copper containing a solution of tin and the leys of wine. Here it remains for some time, and when taken out assumes a white though dull appearance ; in order therefore to give it its polish, it is put into a tub containing a quantity of bran, which is set in motion by turning a shaft that runs through its centre, and thus by means of friction it becomes entirely bright. The pin being complete nothing remains but to separate it from the bran, which is performed by a mode exactly similar to the winnowing of corn : the bran flying off, and leaving the pin behind for immediate sale.

NEEDLES.

In the making of needles, the first thing is to pass the steel through a coal fire and under a hammer to bring it to a round form. This done, it is drawn through a large hole of a wire drawing iron, and returned into the fire, and again drawn through a second hole smaller than the first, and thus successively from hole to hole till it has acquired the degree of fineness for the purpose of needles ; observing every time it is to be drawn, to grease it over with lard, to render it more manageable. The steel thus reduced is cut to the proper length of the needles ; these pieces are flatted at one end on the anvil, to form the head or eye ; they are then put into the fire to soften them farther, and thence taken out, and pierced at each extreme of the flat part of the anvil by force of a puncheon of well tempered steel, and laid on a leaden block, to bring out with another puncheon, the little piece of steel remaining in the eye. The corners are then filed off the square of the heads, and
a little

a little cavity filed on each side of the flat of the head ; this done the point is formed with a file, and the whole filed over : they are then laid to heat red hot, on a long narrow iron, crooked at one end with charcoa: fire ; and when taken out thence, are thrown into a bason of cold water to harden. On this operation a good deal depends ; too much heat burns them, and too little leaves them soft : the medium is learned by experience. When thus hardened, they are laid in a shovel on a fire, more or less brisk. This serves to temper, and to take off their brittleness. They are then straightened one after another with the hammer ; and the next process is the *polishing* them ; to do this they take 12 000 or 15 000 needles, and range them in little heaps on a piece of new buckram sprinkled with emery dust ; they are afterwards sprinkled with oil of olives ; at last the whole is made up into a roll, and laid on a polishing table, and over it a thick plank loaded with stones, which two men work backwards and forwards ; by which means the needles withinside become insensibly polished. When taken out, they are washed with hot water and soap, and wiped in bran.

The good are now separated from the bad ; the points are smoothed with an emery stone, turned with a wheel. This operation finishes them, and nothing remains but to make them up in packets of 250 each. Needles were first made in England by a native of India, in 1545, but the art was lost at his death : it was however recovered by one *Christopher Greening* in 1560.

This very familiar little instrument, makes a very considerable article of commerce : and the consumption thereof is almost incredible. The German and Hungary steel is of most repute for needles.

BLEACHING.

BLEACHING.

BLEACHING, or **Blanching**; the art of whitening linens, stuffs, filks, and other matters.

Bleaching of silk. While it is yet raw, it is put in a thin linen bag, and thrown into a vessel of boiling river-water, wherein soap has been dissolved, then boiled two or three hours, and the bag being turned several times, taken out, beaten and washed in cold water, slightly wrung out, and thrown into a vessel of cold water mixed with soap and a little indigo: the indigo gives it the blueish cast always observed in white filks. After taking it out of the second vessel, it is wrung out, and all the water and soap expressed, shook out, to untwist and separate the threads, and hung up in the air, in a kind of stove made on purpose, wherein is burnt sulphur; the vapour whereof, gives the last degree of whiteness to the silk.

Bleaching of woollen stuffs.—There are three manners of whitening stuffs; the first with water and soap; the second with vapour of sulphur; the third with chalk, indigo, and vapour of sulphur.

For the first, the stuffs being taken from the fulling-mill, are put into soaped water, pretty hot, and worked a-fresh by force of arms over a bench which finishes the whitening the fulling-mill had begun; and lastly, washed out in clear water and dried; this is called the *natural way of blanching*.

In the second method, they begin by washing the stuff in river-water; it is then laid to dry on poles, and when half dry, spread out in a kind of stove well closed, wherein is burnt sulphur; the vapour whereof diffusing itself, sticks by a little and a little over all the stuff, and gives it a fine whitening; this is commonly called, *bleaching by the flower*.

In the third method, after the stuffs have been washed, they are thrown into cold water impregnated with chalk and indigo; after they have been well agitated here, they are washed a-fresh in clearwater, half dried on poles, and spread in a stove to receive the vapour of the sulphur

fulphur; which finishes the operation. This is not esteemed the best method of bleaching, though agreeable enough to the sight.

It may be here observed, that when a stuff has once received the steam of sulphur, it will scarcely receive any beautiful dye, but black or blue.

Bleaching of hollands or fine linens.—After taking them from the loom, while yet raw, they are steeped a day in fair water, washed out and cleared of their filth, in a tub filled with a cold lixivium, or lie. When taken out of the lie, they are washed in clear water, spread on a meadow, and watered from time to time, with water from little dykes, or canals along the ground, by means of scoops, or hollow peels of wood, called by the Dutch, who pretend to be the inventors of them, *gieter*. After lying a certain time on the ground, they are passed through a new lie, poured on hot; and again washed in clear water, soaped with black soap, and that soap again washed out in clear water: they are then steeped in cow's milk, the cream first skimmed off, which finishes their whitening and scowering, gives a softness, and makes them cast a little nap: when taken out of the milk, they are washed in clear water for the last time.

After all this process, they give the linen its first blue, by passing it through a water wherein a little starch, smalt and Dutch lapis have been steeped. Lastly the proper stiffness and lustre is given with starch, pale smalt, and other gums, the quantity and quality whereof may be adjusted according to occasion.

In fine weather, the whole process of bleaching is compleated in a month's time; in ill weather it takes up six weeks or more.

Bleaching of coarse linens. They are taken from the loom, and laid in wooden frames, full of cold water; where, by means of wooden hammers, worked by a water-mill, they are beat so, as insensibly to wash and purge themselves of their filth; then spread on the ground, where the dew which they receive for eight days, takes off more of their impurity; then put into a kind of wooden tubs, or pans, with a hot lie over

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them. Thus lixiviated, they are again purged in the mill, laid a-fresh on the ground, and after eight days more, passed through a second lie, and all things repeated, till such time as they have acquired their just degree of whiteness.

Bleaching, according to the process in Scotland, differs from some of the particulars above described.

DYEING.

THE dyeing art is of *great antiquity*; as appears from the traces of it in the oldest sacred, as well as profane writers. The honour of the invention is attributed to the Tyrians; though what lessens the merit of it is that it is said to have owed its rise to chance.

The juices of certain fruits, leaves, &c. accidentally crushed, are supposed to have furnished the first hint: *Pliny* assures us, that even in his time the Gauls made use of no other dyes: it is added, that coloured earths, and minerals, washed and soaked with rain, gave the next dyeing materials. But purple, an animal juice, found in a shell fish, and *purpura*, seems from history to have been prior to any of them. This indeed was reserved for the use of kings and princes; private persons were forbidden by law to wear the least scrap of it. The discovery of its tinging quality is said to have been taken from a dog, which having caught one of the purple fishes among the rocks, and eaten it up, stained his mouth and beard with the precious liquor; which struck the fancy of a Tyrian nymph so strongly, that she refused her lover Hercules any favours till he had brought her a mantle of the fine colour.

Salts the only means of fixing colours.---The salts are the only means we are acquainted with by which any colouring substance can be made to fix itself upon those matters which are the common subjects of dyeing. A solution of cochineal, for instance, will of itself impart no permanent colour to a piece of woollen cloth put into it. The red colour of the cochineal will indeed stain the cloth while it remains immersed in the solution; but

but as soon as it is taken out and washed, this temporary stain will immediately vanish, and the cloth become as white as before. If now the cloth is dipped in a solution of a saline substance, and then immersed in the solution of cochineal for some time, it will come out permanently coloured; nor will the colour be discharged even by washing with soap and water.

Of the colouring materials with true and false dyes.---

The materials for dyeing different colours are many and various. Some ingredients produce durable colours, which cannot be discharged either by exposure to the air, or by washing with soap: others, though they may be made to stand the action of soap pretty well, cannot by any means be enabled to resist the action of air. These are distinguished by the different names of *true* and *false*, *permanent* and *fading*, &c. nor is there any method yet discovered of giving the false colours an equal degree of durability with the true ones. This hath been attempted by mixing a permanent and a fading colour together; in which case it was thought that the former would impart somewhat of its durability to the latter; but this has always been found to misgive; the fading colour soon flying off and leaving the permanent one behind. The same hath also been attempted by dyeing a piece of stuff partially with a fading colour, and then completing the dye with a permanent one. In this case it was hoped that the fading colour being covered over, and defended from the injuries of the air, by the permanent one, would necessarily become equally durable, or at least remain a much longer time than if the stuff was dyed with it alone. But this also has been found ineffectual; and the fading colour hath been dissipated as soon when covered with a permanent one, as when left without any such cover. Solution of tin in aqua regia will give most of the fading colours a high degree of beauty, and some share of durability, though even that is not able to make them equal to the others. The most permanent dyes we have, are cochineals and gum lac for fine reds and scarlets; indigo and woad for blue: and when mixed in different proportions with cochineal, or lac, for purple and violet colours.

Weld and some other vegetables, for yellow ; and madder for coarse reds, purples, and blacks. The fading colours are much more numerous. In this class are included brazil-wood, log-wood, peach-wood, red-wood, fustic, turmeric root, annotto, archil, &c. &c.

Salts to be used in dyeing.---With regard to the salts made use of in dyeing, it hath been but too often customary to mix together a quantity of different ones, and often the efficacy of the whole hath been totally destroyed, and the colour entirely spoiled by such injudicious management. It is the nature of many salts to destroy one another whenever they come into perfect contact, by being dissolved in water. Thus, solution of tin and saccharum saturni destroy one another ; and so do solution of tin and tartar, or cream of tartar. To mix these together must therefore be absurd ; and yet we find this last mixture ordered in almost every receipt for dyeing scarlet. It is also to be observed, that a mixture of different salts ought never to be made, out of a notion that the colour will keep better on that account ; for most commonly it will keep the worse. A single salt will answer for this purpose, better than a hundred. A mixture should only be made where it is necessary to produce the colour desired ; and if a dyer proceeds in this simple manner, he may not only attain to great perfection in the art from his own experience without being taught by others, but even make considerable discoveries ; as dyeing is at present far from being brought to perfection. The salts chiefly to be used in dyeing, are fixed alkalies, solutions of tin in the vitriolic and marine acids, and in aqua regia ; sugar of lead ; cream of tartar ; alum ; oil of vitriol : and solution of iron in the acetous acid. By means of these, almost all kinds of colours may be dyed at an easy rate, and with very little trouble.

Of the manner of using the ingredients, and of producing the different colours.---As the art of dyeing is by the principles above laid down, reduced to a great degree of simplicity, almost all the directions for the practice will be contained in the following general rule.

General rule for dyeing all colours.---Having cleared the substance to be dyed as well as possible, and made choice

choice of the salt proper for producing the colour desired, dissolve the salt in water, and steep the substance in that solution for 24 hours. Then take it out ; and without wringing, hang it up to dry, but without heat, and for this it will be proper to allow a pretty long time ; for the more perfectly the salt penetrates the cloth, the more durable will the colour be. Having then prepared a coloured solution or decoction, put the cloth into it. The less heat that is applied during the time the cloth remains in the dye, the finer the colour will be, but the longer time will be required for completing the operation. If time cannot be spared, so that a strong heat must be applied, it will be necessary to roll the cloth during the time of dyeing, or the colour will be in danger of proving unequal. After the dyeing is completed, rinse the cloth in cold water, but do not wring it severely ; and then hang it up to dry.

In this way may be dyed a great variety of colours, on wool, silk, cotton, and linen, without any variation in the process. Solution of tin in the vitriolic acid will produce all degrees of red, from the palest pink or rose colour, to the highest crimson and scarlet ; and that on all the abovementioned substances without exception.

Method of dyeing cotton and linen scarlet.—A method of producing these fine colours upon cotton and linen, as well as wool, has been a great desideratum in dyeing, but by the abovementioned solution these substances may be dyed of the most beautiful red, crimson, and scarlet colours, as any one may very readily satisfy himself by a trial. The same thing may be done by solution of tin in aqua regia : but unless the nitrous acid prevails greatly in the mixture, the colours produced by this last will incline more to purple than the former. With solution of tin in the marine acid, they incline remarkably to purple, and are likewise deficient in lustre. The two first solutions therefore are capital ingredients in dying.

Various other colours.—The same preparations will also serve for dyeing all other colours, blue and green excepted. Thus a piece of cloth prepared with solution of tin in the vitriolic acid, if boiled with the decoction of cochineal, will come out of a scarlet colour,

if with turmeric, weld, fustic, or many of the common yellow flowers, it will come out of different degrees of yellow; with brazil wood, peach wood, &c. it will give a fine purplish crimson; with logwood, a fine deep purple, &c. and by combining these together in different ways, an infinity of different shades may be produced.

Green colours are to be produced only by a mixture of blue and yellow; for there is no ingredient yet discovered, that will by itself, produce a good green dye. Sap-green will indeed communicate its own colour to cloth of any kind, and for that purpose is used in some places; but the colours dyed with this ingredient are by no means eligible. It is common first to dye the cloth blue with indigo, and then yellow with any yellow colouring ingredient; by which means a green colour is produced.

Cloth and silk may be dyed green with indigo; but they must first be boiled in the yellow dye, and then in the blue.

Black colours are dyed by preparing the cloth with any solution of iron, (but that in the acetous acid is the best) and then boiling it in a decoction of any astringent vegetable. Those chiefly made use of for the purposes of dyeing, are galls, sumach, logwood, and madder. Of these the last is the most durable; though galls will also produce a pretty lasting colour, if properly managed. Logwood dyes a very pretty, but fading, black colour. It appears however, by an experiment made by Mr. Clegg, that by a proper preparation of the cloth with fixed alkaline salts, black colours dyed with logwood might be improved both as to beauty and durability.

The finest blacks are first dyed blue, with indigo; and afterwards black with a solution of iron, and some astringent vegetable.

These are the best methods of producing permanent colours of all kinds. As it is necessary, however, often to give another colour to stuffs which have been already dyed, it is plain, that it is as necessary for a dyer to know how to discharge colours, as how to make the cloth imbibe them.

Dyeing

Dyeing of *Thread* is begun by scouring it in a ley of good ashes; after which, it is wrung, rinsed out in river water, and wrung again. For a bright blue, it is given with braziletto and indigo. Bright green is first dyed blue, then black-boiled with braziletto and verditer, and lastly woaded. For a dark green, it is given like the former, only darkening more before woading. Lemon or pale yellow, is given with weld, and rocou. Orange and Isabella, with fustic weld, and rocou. Red, both bright and dark, with flame-colours, &c. are given with brazil, either alone, or with a mixture of rocou. Violet, dry rose, and amaranth, are given with brazil, taken down with indigo. Fuel-mort and olive colour are given with galls and copperas, taken down with weld, rocou or fustic. Black is given with galls and copperas, taken down and finished with braziletto wood.

Dyeing of *Hats*, is done by boiling logwood, gum, and galls, in a proper quantity of water for some hours; after which verdigris, and green vitriol are added, and the liquor kept simmering, or of a heat a little below boiling. Ten or twelve dozen of hats are immediately put in, each on its blocks and kept down by cross bars for about an hour and a half; they are then taken out and aired, and the same number of others put in their room; the two sets of hats are then dipped and aired alternately, eight times each; the liquor being refreshed each time with more of the ingredients, but in less quantities than at first. This process affords a very good black on woollen and silk stuffs as well as on hats.

Dyeing of *Leather, Skins, &c.* A black colour is easily given to tanned leather, by rubbing it over three or four times with a solution of vitriol, or with a solution of iron in the vegetable acids. For leathers that have not been tanned, some galls or other astringents are added, to the solution of iron; and in many cases, particularly for the finer parts of leather, and for renewing the blackness, ivory, or lamp-black are used. A blue colour is given by steeping the subject a day in urine and indigo, then boiling it with alum: or it may be given by tempering the indigo with red wine,

wine, and washing the skins therewith. Red is given by washing the skins, and laying them in galls; then wringing them out; dipping them in a liquor made with ligustrum, alum, and verdigris in water; and lastly, in a dye made of brazil wood boiled with ley. Purple is given by wetting the skins with a solution of roch alum in warm water, and when dry again, with the hand with a decoction of logwood in cold water. Green is given by smearing the skin with sap-green and alum-water boiled; to darken the colour, a little more indigo may be added. Dark green is also given with steel-filings, and sal armoniac steeped in urine till soft, then smeared over the skin, which is to be dried in the shade. Sky colour is given with indigo steeped in boiling water, and the next morning warmed and smeared over the skin. Yellow, smearing the skin over with aloes and linseed oil dissolved and strained: or by infusing it in weld. Orange-colour is given by smearing with fustic berries boiled with alum-water; or for a deep orange, with turmeric.

Dyeing or staining of *Wood*; for inlaying veneering, &c. Red, is done by boiling the wood in water and alum; then taking it out, adding brazil to the liquor, and giving the wood another boil in it. Black, by brushing it over with logwood boiled in vinegar, hot; then washing it over with a decoction of galls and coperas till it be of the hue required. Any other colour may be given by squeezing out the moisture of horse-dung through a sieve, mixing it with roch alum and gum arabic; and to the whole adding green, blue, and any other colour designed. After standing two or three days, pear-tree or other wood, cut to the thickness of half a crown, is put in the liquor boiling hot, and suffered to remain till it be sufficiently coloured.

Dyeing of *Bone, Horn, or Ivory*. Black is performed by steeping brass in aqua fortis till it be turned green: with this the bone, &c. is to be washed once or twice: and then put in a decoction of logwood and water, warm. Green is begun by boiling the bone, &c. in alum-water; then with verdigris, sal armoniac, and white wine vinegar; keeping it hot therein till sufficiently

sufficiently green. Red, is begun with boiling it in alum-water, and finished by decoction in a liquor compounded of quick-lime steeped in rain-water, strained, and to every pint an ounce of brazil wood added: the bone, &c. to be boiled till sufficiently red. Other methods are given by *Salmon*. And from him by *Houghton*.

SOAP.

SOAP, or Sope; a kind of paste, sometimes hard and dry, and sometimes soft and liquid; much used in washing, and whitening linens, and for various other purposes, by the dyers, perfumers, hatters, fullers, &c.

The manufacture of Soap in London, first began in the year 1524, before which time that city was served with white soap from foreign countries, and with grey soap, speckled white from Bristol, and sold for a penny a pound, and also black soap for a halfpenny the pound.

The principal soaps of our manufacture, are the soft, the hard, and the ball-soap. The soft soap, again is either white or green: the process of making each kind, is as follows.

Green soft soap.—The chief ingredients used in making this, are lyes drawn from pot-ash and lime, boiled up with tallow and oil. First, the lye and tallow are put into the copper together, and when melted, the oil is put to it, and the copper made to boil; then the fire is dampt or stopt up, while the ingredients lie in the copper to knit or incorporate; which done the copper is set on boiling, being fed or filled with lies as it boils, till there be a sufficient quantity put therein: then it is boiled off with all convenient speed, and put into casks.

White soft soap.—One sort of white soap is made after the same manner as green soft soap is, oil excepted, which is not used in white.—The other sort of white soft soap, is made from lyes of ashes of lime boiled

boiled up at twice with tallow.—First, a quantity of lyes and tallow are put into the copper together, and kept boiling : being fed with lyes as it boils, until it grains, or is boiled enough : then the lyes are separated or discharged from the tallowish part, which part is removed into a tub, and the lyes thrown away : this is called the first half boil. Then the copper is charged again with fresh tallow and lyes, and the first half boil is put out of the tub into the copper a second time : where it is kept boiling with fresh lyes and tallow, till it comes to perfection. It is then put out of the copper into the same sort of casks as are used in green soft soap.

Hard soap is made with lyes and tallow, and most commonly boiled at twice : the first called a half-boiling, hath the same operation as the first half-boil of soft white soap. Then the copper is charged with fresh lyes again, and the first half-boil put into it, where it is kept boiling, and fed with lyes as it boils, till it grains, or is boiled enough ; then the lye is discharged from it, and the soap put into a frame to cool and harden.

Note, there is no certain time for bringing off a boiling of any of these sorts of soap : it frequently takes up part of two days.

Ball Soap, commonly used in the north, is made with lyes from ashes and tallow. The lyes are put into the copper and boiled till the watry part is quite gone, and there remains nothing in the copper but a sort of nitrous matter, the very strength and essence of the lye, to this the tallow is put, and the copper kept boiling and stirring for above half an hour, in which time the soap is made ; and then it is put out of the copper into tubs or baskets with sheets in them, and immediately, whilst soft, made into balls. Note, it requires near twenty-four hours to boil away the watry part of the lye.

Soaps both dry and liquid, are held of some use in medicine, the liquid against fevers, to be applied by rubbing the soles of the patient's feet therewith ; and the dry dissolved with the spirit of wine, in the cure of cold humours.

Soap

Soap Earth, *seapies*, a smooth, unctuous kind of earth, found in the Levant and used as soap.

The soap earth, *Dr. Smith* tells us, is only had in two places near Smyrna. It is in effect, of itself, a fine soap, boiling and shooting up out of the earth.

It is gathered always before sun-rise, and in morning, when there falls no dew; so that a stock must be laid up in the summer months, to serve all the year.

In some places, it comes up an inch or two above the surface of the ground; but the sun rising on it makes it fall again. Every morning there returns a fresh crop.

CANDLES.

Of *tallow* Candles there are two sorts; the *dipped*, and the *moulded*. The moulded are the invention of the *Sieur le Brege* at Paris.

In *making* Candles, the general method is after weighing and mixing the tallow in due proportions, to cut it into small pieces, to melt the sooner and the better.—Being properly melted and skimmed, they pour a certain quantity of water into it in proportion to the tallow. This serves to precipitate all remaining impurities to the bottom. No water, however, must be thrown into the tallow designed for the *three first dips*; because the wick would imbibe the water. This makes the candles crackle in burning, and renders them of bad use.—The tallow thus melted is poured into a tub, through a coarse sieve of horse-hair, to purify it still more, and may be used after having stood three hours. It will continue fit for use twenty-four hours in summer, and fifteen in winter.

The *wicks* are made of spun cotton, several threads of which the tallow-chandlers buy in skeins, and wind up into bottoms or clues. From whence they are cut off with an instrument, continued on purpose, into pieces of the length of the candle; and then put on the sticks for dipping.

If a tallow candle be good, there must be an equal
quantity

quantity of sheep's and bullock's tallow. Hog's tallow makes the candles gutter, and always gives an offensive smell, with a thick, black smoke. The *wick* ought to be properly twisted, sufficiently dry and pure, otherwise the candle will emit an irregular, inconstant flame.

Wax Candles.—The *wick* of wax candles is made of cotton or flax. They are slightly twisted, and covered with white or yellow wax. Of these candles there are several kinds: some of a *conical* figure, that is somewhat in the form of a sugar loaf, broad at bottom, and becoming taper towards the top. These are used in funeral processions, &c. Others are of a *cylindrical* form, used on ordinary occasions: by cylindrical is meant a long round body of *equal* size in every part.

To make *wax candles* with a *ladle*, they have an iron circle on which they hang a dozen wicks, at equal distances: held over a large basin full of this melted wax. A large ladle full of this wax is poured gently on the tops of the wicks, one after another: and this operation is continued till the candle arrive at its proper bigness. The three first ladles must be poured on the *top*, the fourth, fifth and sixth lower down, at certain distances, to give the candle its conical or pyramidal form. The candles are then taken down and afterwards rolled and smoothed upon a walnut tree table, with a long square instrument of box, smooth at the bottom.

When wax candles are made by the *hand*, they begin to soften the wax by working it in hot water, in a narrow but deep caldron. A piece of wax is then taken out, and disposed by a little and little around the wick.

Wax candles are either made as the former, with a ladle, or *drawn*. The latter are really drawn in the manner of wire, by means of two large rollers of wood, turned by a handle; which pass the wick through melted wax contained in a brass basin, and at the same time through the holes of an instrument.

Dr. Franklin suggested that the flame of two candles *joined*, would give a much stronger light than both of them separate, which is proved to be just.

Candles

Candles kept in bran or flour, it is said, causes them to last almost as long again in burning.

The Roman candles were at first little strings dipt in pitch, or surrounded with wax, though afterwards they made them of the papyrus, covered still with wax, and sometimes of rushes by stripping off the outer rind, and only retaining the pith.

Rush candles, used in different parts of England, are made of the *pith* of a sort of rushes, peeled, and dipped in melted grease.

Candle wood, slips of pine about the thickness of a finger, used in New England, and other places, to burn instead of candles, giving a very good light. The French inhabitants of Tortuga, use slips of yellow fan-tal-wood, for the same purpose, which yields a clear flame, though of a green colour.

Mould Candles are so called because made in moulds of brass, tin, or lead; but tin is the best. Each candle has its mould. A number of these moulds are placed in a table full of holes, and filled with melted tallow. After the moulds have stood long enough to cool, the candles are drawn out; and they are sometimes rendered whiter by hanging them on rods, exposed to the dew and earliest rays of the sun for several days.

STARCH.

STARCH is a sediment found at the bottom of vessels wherein wheat has been steeped in water, of which sediment, after separating the bran from it, by passing it through sieves, they form a kind of loaves. This being dried in the sun, or an oven, is afterwards broke into little pieces and sold.

The best is white, soft, and easily broken into powder: but such as require very fine starch, do not content themselves like the starchmen with refuse wheat, but use the finest grain. The process of making starch of wheat is as follows.

The grain is put to *ferment* in vessels full of water, and exposed to the greatest heat of the sun, for several days

days: when the grain bursts easily under the finger, they judge it sufficiently fermented. It is now put into a canvas bag, to separate the flour from the husks, which is done by beating and rubbing it over a vessel: as this vessel fills with the *liquid flour*, a red-dish water is seen swimming on the top, which must be skimmed off from time to time: and fresh water added. This is again strained through a sieve, and what is left behind is put into a vessel with new water and exposed to the sun for some time. After draining off the water, what *remains at the bottom* is the starch, which they cut in pieces to get out, and leave it to dry in the sun, for use.

Those who use only the refuse of wheat, observe only a *part* of this process, but the starch falls far short of this. Starch is used along with finalt or stone blue, to stiffen or clear linen: Starch made into a fine powder, is used as powder for the hair.

PAPER.

PAPER; sheets of a thin matter, made of some vegetable substance. The materials on which mankind have, in different ages, contrived to write their sentiments, have been extremely various; in the early ages they made use of stones, and tables of wood, wax, ivory, &c.

Paper with regard to the manner of making it, and the materials employed therein, is reducible to several kinds; as Egyptian paper, made of the rush papyrus; bark paper, made of the inner rind of several trees; cotton paper; incombustible paper; and European paper, made of linen-rags.

Linen or European paper appears to have been first introduced among us towards the beginning of the 14th century; but by whom this valuable commodity was invented, is not known. The method of making paper of linen or hempen rags, is as follows: the linen rags being carried to the mill, are first sorted: instead of the old method of pounding the rags to pulp with large

large hammers, they now make use of an engine, which performs the work in much less time. This engine consists of a round solid piece of wood, into which are fastened long pieces of steel, ground very sharp. This is placed in a large trough with the rags, and a sufficient quantity of water. At the bottom of the trough is a plate with steel bars, ground sharp like the former; and the engine being carried round with prodigious velocity, reduces the rags to a pulp in a very short time. It must be observed, that the motion of the engine causes the water in the trough to circulate, and by that means constantly returns the stuff to the engine. The trough is constantly fed with clear water at one end, while the dirty water from the rags is carried off at the other, through a hole, defended with wire gratings, in order to hinder the pulp from going out with the dirty water.

When the stuff is sufficiently prepared as above, it is carried to the vat, and mixed with a proper quantity of water, which they call priming the vat. The vat is rightly primed, when the liquor has such a proportion of the pulp, as that the mould, on being dipped into it, will just take up enough to make a sheet of paper of the thickness required. The mould is a kind of sieve exactly of the size of the paper to be made, and about an inch deep, the bottom being formed of fine brass wire, guarded underneath with sticks, to prevent its bagging down, and to keep it horizontal; and further to strengthen the bottom, there are large wires placed in parallel lines, at equal distances, which form those lines visible in all white paper when held up to the light: the mark of the paper is also made in this bottom, by interweaving a large wire in any particular form. This mould the maker dips into the liquor, and gives it a shake as he takes it out, to clear the water from the pulp. He then slides it along a groove to the coucher who turns out the sheet upon a felt laid upon a plank, and lays another felt on it; and returns the mould to the maker, who by this time has prepared a second sheet in another mould: and thus they proceed, laying alternately a sheet and a felt, till they have made six quires of paper, which is called a post; and

this they do with such swiftness, that in many sorts of paper, two men make 20 posts and more in a day. A post of paper being made, either the maker or coucher whistles ; on which four or five men advance, one of whom draws it under the press, and the rest press it with great force, till all the water is squeezed from it ; after which it is separated sheet by sheet from the felts, and laid regularly one sheet upon another ; and having undergone a second pressing, it is hung up to dry. When sufficiently dried, it is taken off the lines, rubbed smooth with the hands, and laid by till sized, which is the next operation. For this they choose a fine temperate day, and having boiled a proper quantity of clean parchment or vellum shavings, in water, till it comes to a size, they prepare a fine cloth, on which they strew a due proportion of white vitriol and roach alum finely powdered; and strain the size through it into a large tub ; in which they dip as much paper at once as they can conveniently hold, and with a quick motion give every sheet its share of the size, which must be as hot as the hand can well bear. After this, the paper is pressed, hung up sheet by sheet to dry ; and being taken down is sorted, and what is only fit for out side quires laid by themselves : it is then told into quires, which are folded and pressed. The broken sheets are commonly put together, and two of the worst quires are placed on the outside of every ream or bundle ; and being tied up in wrappers made of the settling of the vat, is fit for sale.

Paper is of various kinds, and used for various purposes : with regard to colour, it is principally distinguished into white, blue and brown ; and with regard to its dimensions, into atlas, elephant, imperial, super-royal, royal, medium, demy, crown, fools cap, and pot paper.

In the Maldivée islands, the natives are said to write on the leaves of a tree called *Macarequean*, which are a fathom and a half long and a foot broad, and in divers parts of the East Indies, the leaves of the *Musa Arbor* or Plantain tree, dried in the sun, served the same use, till of late that the French taught them the use of European paper.

Egyptian

Egyptian Paper, is that which was principally used among the ancients; made of a rush called *Papyrus* or *Biblus*, growing chiefly in Egypt, about the banks of the Nile; though it was also found in India; and *Guilandinus* assures us, he saw in Chaldea, at the confluence of the Tigris and Euphrates, large fens, wherein with his own hands he plucked a papyrus differing in nothing from that of the Nile. *Strabo* likewise speaks of a sort of papyrus growing in Italy, but we do not find it was ever used for making paper.

The description given by *Pliny* of the *papyrus* or *paper rush*, is somewhat obscure. Its root according to him, is of the thickness of a man's arm, and ten cubits long; from this arise a great number of triangular stalks 6 or 7 cubits high, each thick enough to be easily spanned. Its leaves are long like those of the bull-rush; its flowers staminous, ranged in clusters at the extremities of the stalks: its roots woody and knotted like those of rushes, and its taste and smell near a kin to those of the *Cyperus*.

Marbled Paper is a sort variously stained, or painted as it were with divers colours.

For the operation of marbling; gum is first dissolved in a trough into which they plunge each sheet of paper; this done, and all the colours ranged on the table, where also the trough is placed, they begin by dipping a brush of hog's hair into any colour, commonly the blue first, and sprinkle it on the surface of the liquor. The red is next applied in the like manner, but with another pencil. After this the yellow, and lastly the green.

When all the colours are thus floating on the liquor, to give them that agreeable cambleting which we admire in marble paper, they use a pointed stick, which being applied by drawing it from one end of the trough to the other with address, stirs up the liquor and fluctuating colours.

SUNDRIES.

BUTTON needs no description. Buttons are made of various materials as mohair, silk, horse-hair, metal, &c.

Metal Buttons.---The metal with which the moulds are intended to be covered is first cast into small ingots, and then flatted into thin plates or leaves, at the flating mills; it is afterwards cut into small round pieces, of the size suited to the button mould; each piece of metal thus cut out, the plate is reduced to the form of a button, by beating it successively in several cavities or concave moulds: This plate is generally called by workmen the *cap of the button*.

The form being thus given to the plates or caps they strike the intended impression on the *convex* side, by means of an iron puncheon, in a kind of mould, engraved *en creux*.

The plate thus prepared makes the cap of the button: the under part, upon which this cap is placed, is another plate, flat and without any impression, and to this under plate is soldered a small eye made of wire, by which the button is to be fastened.

Sometimes instead of the under plate, a wooden mould is used. The cap is fastened to the mould with a cement, which renders the button firm and solid, the cement entering all the cavities formed by the relieve of the other side, sustains it, prevents its flattening, and preserves its boss or design.

Common Buttons are generally made of mohair; some are made of silk and others of thread, but the latter are of a very inferior sort. In order to make a button, the mohair must be previously wound upon a bobbins, and the mould fixed upon a board, by means of a bodkin thrust through the whole in the middle of it. This being done the workman wraps the mould in three, four, or six columns, according to the button.

The moulds of the *horse hair buttons* are covered with a kind of stuff, composed of silk and hair; the warp being belladine silk and the shoot horse hair. This stuff is wove with two selvages, in the same manner and

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in the same loom as ribbands; it is then cut into square pieces, wrapt round the moulds, and their selvages stitched together, which form the under part of the button.

When these buttons come from the maker's hands, they undergo another operation to render them glossy and beautiful. In order to take off all the superfluous hairs knobs of silk, a quantity of buttons are put into a kind of iron sieve. Then a little spirit of wine being poured into a kind of shallow iron dish, and set on a fire, the workman moves and shakes the sieve, containing the buttons briskly over the flame of the spirit, by which the superfluous hairs and silk are burnt off, without damaging the buttons. They are lastly put into a leather bag, with a quantity of the crumbs of bread; this operation, by shaking them sufficiently together, cleanses the buttons, and renders them very glossy and fit for sale.

Gold Twist Buttons are first covered in the same manner as *common* buttons. Then the whole is covered with a thin plate of gold or silver. It is afterwards wrought all over with *purle* and *gimp*. *Purle* is a kind of thread composed of silk and gold wire twisted together. *Gimp*, are fine small tubes of gold or silver about the tenth of an inch long. These are joined together by a fine needle filled with silk, thrust through their apertures, in the same manner as beads.

CARPET; a sort of covering of stuff, or other materials wrought with a needle or on a loom. Persian and Turkey carpets are those most esteemed; though at Paris there is a manufactory after the manner of Persia, where they make them little inferior, not to say finer than the true Persian carpets. They are velvety and perfectly imitate those that come from the Levant.--- There are also carpets of Germany, some of which are made of woollen stuffs, as serges, &c. and others are made of wool also, but wrought with the needle and embellished with silk; and lastly there are some made of dogs-hair. We have likewise carpets made in Britain, and though we are not arrived at such perfection as our neighbours the French, it may be for want of the like public encouragement.

PUTTY,

PUTTY, sometimes denotes powder of calcined tin used in polishing and giving the last gloss to work of iron and steel.

The Putty, commonly used by the glaziers, is compounded of linseed-oil and whiting, with or without the addition of whitelead. The whiting is first ground very fine; the above ingredients are then well worked up and incorporated with each other: this process will take a fortnight or three weeks before it be fit for use.

The *Putty* which pewterers use for polishing, is differently made.

BIRDLIME; a viscid substance prepared various ways and from various materials, for the catching of birds, mice and other vermin.

It is made from holly bark, boiled for several hours, when the green coat being separated from the other, is covered up a fortnight in a moist place, then pounded into a tough paste, that no fibres of the wood be left, and afterwards washed in a running stream. It is then put to ferment and soon laid up for use. In using, a third part of nut oil, or any thin grease is incorporated with it.

WAX; a soft, yellowish matter, whereof the bees form cells to receive their honey.

Wax is not the excrement of this laborious insect, as the ancients and after them many of the moderns have imagined. It is properly a juice, exuding out of the leaves of plants, and adhering to the surface thereof; from which it is scraped off by the bees, with their rough thighs, to build their combs with. It is chiefly afforded by lavender and rosemary; from which last any body may gather wax; and by the assistance of the microscope, the wax may be plainly seen sticking on the leaves of the plant. So that wax is not an animal, but a vegetable substance.

The *Honey* is formed of a liquid matter, sucked into the body; and only seems to arrive at its perfection, in the entrails of the little insect; whereas the wax being a hard substance, is gathered only with the fore legs and chaps; conveying thence to the middle legs, and
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thence to the middle joint of the hind legs, where there is a small cavity, like the bowl of a spoon to receive it : and where it is collected into heaps, of the shape and size of lentils.

The bee arrived at the hive with a load of wax, finds some difficulty in unburdening himself of so tenacious a matter. Frequently being unable to lay it down himself, he calls for assistance, by a particular motion of the legs and wings ; upon which a number of his companions soon run to his succour, and each with his jaws takes off a small quantity of the wax ; others succeeding, till their laden fellow be quite disburdened.

Sealing Wax, or *Spanish wax*, is a composition of gum lacca, melted and prepared, with rosin and chalk, and coloured red with ground cinabar.

WHALEBONE is used as stiffening in stays, fans, busks, screens, &c. The Whale properly so called, instead of teeth, has a kind of whiskers in his throat, about a span broad, and fifteen feet long, ending in a sort of fringe much like swine's bristles. They are set in the palate, and do in a great measure the office of teeth. These whiskers split and fashioned, are what we call whalebone.

POUNCE is a little heap of charcoal-dust inclosed in some open stuff ; to be passed over holes pricked in a work, in order to mark the lines or designs on a paper underneath. The word is formed from the French, *ponce*, pumice stone, because they anciently used only pumice stone powdered for this purpose. Pounce is used by embroiderers to transfer their patterns upon their stuffs, and also by lace-makers, and occasionally by writing masters, though not so much as formerly.

CHARCOAL ; a sort of fuel consisting of wood half burnt. The microscope discovers a surprising number of pores in charcoal ; it is to this that the blackness of charcoal is owing, for the rays of light striking on the charcoal are absorbed instead of being reflected ; blackness in a body, being no more than a want of reflection.

Dr.

Dr. Priestly has well explained the noxiousness of air infected with the fumes of charcoal. Instrument-makers, &c. find charcoal useful in polishing their brass and copper-plates, after having been rubbed clean with powdered pumice stone.

The *method of making* is to cut oak wood into lengths and pile it up, and cover it with turf, &c. Fire is then set to the pile and vent holes are made in several places through the turf, observing as the pile cools and sinks, it must be fed with short wood, that no part may remain unfired : and where any part *chors* too fast the vent must be stopped. A parcel is thus burnt in five or six days, it must cool very gradually.

Charcoal for powder-mills is usually made of elder-wood ; the process is the same but finished in two days.

BOTTLES.—Glass-bottles are better for cyder than those of stone. Foul glass bottles are cured by rolling sand or small shot in them. But *Dr. Percival* cautions against the practice of cleaning wine bottles with leaden shot. It frequently happens, he thinks, through inattention, that some of the little pellets are left behind ; and when wine or beer is again poured into the bottles, this mineral poison will slowly dissolve ; and impregnate those vinous liquors, with its deleterious qualities. The sweetness which is sometimes perceived in red port wine, may arise from this cause when it is neither designed nor suspected.

POT-ASHES are properly the lixivious ashes of certain vegetables, used in the making of glass and soap. Such are the ashes of the herb *kali*, called salt wort and glass weed, as described under *Glass*. Pot-ashes also make the basis of *salt of tartar*. The English and Dutch make a considerable commerce of pot-ashes, which they bring from about the Black Sea, and use great quantities thereof in the preparation of their cloths, as those ashes are found excellent to scour with. Pot-ashes is also a denomination popularly applied to all those kinds of ashes bought up and down the country, and mixed together for the making of glass. The best

best of English pot-ashes are those made of the smaller common highway thistle ; though all thistles are good. Fern also makes excellent pot-ashes.

HORN is a hard substance growing on the head of divers animals. Horns make a considerable article in the arts and manufactures, bullocks horns softened by the fire serve to make lanthorns, combs, inkhorns, tobacco-boxes, and numerous other articles.

IVORY ; the tooth or tusk of the elephant, growing on each side of his trunk, somewhat in the form of an horn. Ivory is much esteemed for its colour, the fineness of its grain, and its polish. The ivory of Ceylon and Achem, never become yellow, as those of Terra Firma and East-Indies do. Ivory is prepared as a ground for painting, by rubbing it over with juice of garlic, this takes off the greasiness which would otherwise prevent the paint from fixing. Ivory has the same medical virtue, with hartshorn ; its shavings too, like those of hartshorn, boiled into a jelly with water, have the same restorative quality.

BONE.---The nature of bone has already been described in the first part of this volume. Of their use in *commerce*, it may be here observed that they are useful for making iron malleable ; for absorbing the sulphur of sulphureous ore : for forming tests and coppells, or vessels for refining gold or silver with lead ; as burnt bones compose a mass of a porous texture, which absorbs vitrified lead and other metals. They are used for the preparation of milky glasses and porcelains : for the rectification of volatile salts ; and of empyrhumatic oils : and also for making glue. The bones of the cuttle fish are used by the goldsmiths for making moulds, those of the cow kind for painter's black, and in lieu of ivory for toys and cutler's work.

To describe the numerous smaller articles into which bone and ivory are wrought up, would be tedious. The toy-shops and other places, exhibit a considerable variety ; and while the less curious inspector will view such trifles only, as to their exterior appearance or prettyness

prettyness, the inquisitive mind will discern in them much art, industry, and ingenuity.

In concluding this part of the work, we may observe indeed, that not only these, but all the various larger, more complicate, and more beneficial manufactories with which cities and countries abound, make up the *volume of art*, and like the volume of nature, is highly worthy the perusal of him who is every hour partaking of its benefits. The young reader should accustom himself to look farther than the *surface* of things; let him fix his eye on any object that presents itself and it will prove worthy of his investigation, and for the state in which he sees it, he will find it indebted to the ingenuity of man. Whether he views the glass which so exactly reflects himself; or examines the mechanism of his watch, or even the texture of the paper now before him; or the characters he is reading, which as, it were, embody thought, and transmit it to any distance of time and place, he may at least derive a selfish pleasure in the idea of enjoying the benefit of inventions, which were almost, or entirely unknown to mankind for many ages.

Numerous inventions that were at first struck out by accident, have been since improved to a high degree of perfection, and it may well raise our astonishment and admiration to discern how the industry and ingenuity of man have made all nature tributary to his wants or his pleasures.

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IF young persons should find some of the foregoing descriptions not very easy to be comprehended, on a first perusal; a second or third reading, with the help of a dictionary may sufficiently illucidate it. But the best method of all is to examine the manufactory itself, and they will find the explanation here given, greatly assist their apprehension of the process: so that what would otherwise, even when seen, appear almost unintelligible, may, it is hoped, by this short description be clearly, justly, and fully understood.